A systematic review and correlational meta-analysis of factors associated with resilience of normally aging, community-living older adults.

Sylwia Górska, PhD[1] Anusua Singh Roy, PhD[1] Lucy Whitehall, PhD[1] Linda Irvine Fitzpatrick, ProfD[2] Nichola Duffy, PGDip[2] and Kirsty Forsyth, PhD[1]

1. School of Health Sciences, Queen Margaret University, Edinburgh, Scotland
2. Edinburgh Health and Social Care Partnership, NHS Lothian, Edinburgh, Scotland

Sylwia Górska: https://orcid.org/0000-0002-6947-3362
Anusua Singh Roy: https://orcid.org/0000-0002-5483-8832
Lucy Whitehall: https://orcid.org/0000-0002-1090-2767
Linda Irvine Fitzpatrick: https://orcid.org/0000-0002-9599-8015
Nichola Duffy: https://orcid.org/0000-0001-6964-8508
Kirsty Forsyth: https://orcid.org/0000-0002-6732-1699

*Address correspondence to: Sylwia Górska, PhD, School of Health Sciences, Queen Margaret University, Queen Margaret Drive, Musselburgh, Scotland, EH21 6UU. E-mail: SGorska@qmu.ac.uk

Funding: This work was jointly supported by National Health Service (NHS) Lothian and Queen Margaret University Edinburgh.

Conflict of Interest: None reported.

Acknowledgements: The authors would like to acknowledge NHS Lothian and Queen Margaret University Edinburgh for their joint financial support of this project.

Abstract

Background and objectives: Global policy emphasizes the need to promote healthy aging through supporting inclusivity, safety, and functional independence. Research indicates that efforts to enhance resilience can contribute to meeting these objectives. We employed meta-analytical approach to examine evidence on resilience in community-living older adults.

Research Design and Methods: We searched electronic databases until 13 January 2020 for observational studies investigating factors associated with resilience in this population. Articles had to provide quantitative data based on standardized assessment and include samples where mean participants' age and lower 95% confidence interval was >55 years. We included 49 studies reported in 43 articles and completed 38 independent meta-analysis, 27 for personal and 11 for contextual factors associated with resilience.

Results: A range of personal and contextual factors were significantly associated with resilience, with effects sizes predominantly small to moderate ($0.1<r<0.49$). Factors reflecting psychological and physical wellbeing and access to / quality of social support were associated with higher resilience. Factors indicative of poorer psychological wellbeing and social challenges were associated with lower resilience. Longitudinal evidence was limited. The level of between study heterogeneity was substantial to considerable. Where relevant analysis was possible, the identified publication bias was also considerable.

Discussion and Implications: The quality of the available evidence, as well as issues related to measurement of resilience, indicate the need for further work relative to its conceptualization and assessment. The presented findings have important clinical implications, particularly within the context of the COVID-19 impact on resilience in older adults.

Key words: Analysis—systematic review, Analysis—meta-analysis, resilience, measurement, personal factors, contextual factors

Background

People worldwide are living longer. By 2050, one in six people in the world will be over 65 (16%), up from one in 11 in 2019 (9%) (United Nations [UN], 2019). Aging presents both challenges and opportunities at individual as well as societal levels (Storey, 2018; World Health Organisation [WHO], 2018). Consequently, governments internationally have been called to develop innovative policies and public services targeted specifically at older adults and aiming to support healthy lives and wellbeing by enhancing inclusivity, safety and resilience within communities (Dugarova, 2017; Ziglio, 2017).

Traditionally, aging has been associated with frailty, vulnerability and loss (Bartley et al., 2019). However, there is considerable variability in the aging process (WHO, 2015). People have intrinsic capacity for positive adaptation throughout their life course (WHO, 2015) which, when supported by their environment, can be used to compensate for loss and changes associated with aging (Wallace et al., 2001). This capacity to positively adapt in response to adversity is called resilience (Lazarus, 1993; Ong et al., 2009). Research suggests that resilience supports the holistic view of healthy aging, predicting happiness, life satisfaction and self-rated health (Fullen et al., 2018; Moore et al., 2015), and buffers against progression of disability (Manning et al., 2016). Therefore, efforts to boost resilience in older adults are of the utmost relevance, particularly in the context of COVID-19 pandemic, as older adults are known to be disproportionately affected in terms of physical and mental health and wellbeing (UN, 2020).

In order to accurately assess resilience and develop effective interventions, clinicians must have at their disposal tools that accurately capture resilience (Cosco et al., 2016). The development of such tools reflects the way resilience is conceptualized (Bartley et al., 2019; Clark et al., 2019). Historically, resilience has been defined as a trait-like construct, consisting of personality characteristics and stable psychosocial factors that contribute to adaptive functioning (Block & Block, 1982; Rutter, 1985; Wagnild & Young, 1993). But, this has been challenged for overlooking time-varying and contextual aspects of resilient coping, as well as a failure to account for the malleability of human functioning or to consider how resilience can be promoted through therapeutic intervention (Bartley et al., 2019; Luthar et al., 2000).

More recent theoretical perspectives conceptualize resilience as a dynamic adaptive capacity, built over time in response to adverse events experienced over the life course (Clark et al., 2018). This process-based theory positions resilience as an outcome of dynamic, complex interplay between multiple personal and contextual dimensions (Clark et al., 2018; Ong et al., 2009). Indeed, many studies (e.g., Bartley et al., 2019; Fullen et al., 2018; Li et al., 2015) have identified a range of personal (e.g., age, depressive symptoms, life satisfaction, self-rated health) and contextual (e.g., education, income, social support networks) factors which influence the resilience of older adults (see Supplementary Tables 7 and 8 for full lists of influential factors and related references).

Such a perspective recognizes resilience as a malleable factor which can be supported by targeted interventions (Bartley et al., 2019). Despite this, previously evaluated resilience interventions have tended to focus on enhancing protective factors within the individual (Lee et al., 2013). This is perhaps unsurprising given that much of the existing literature is focused on psychological resources (Bartley et al., 2019; Cosco et al., 2016; Windle et al., 2011). Moreover, while current research evidence recognizes a multi-system view of resilience (Bolton et al., 2016; Liu et al., 2017; MacLeod et al., 2016) there is neither consensus over its definition nor a 'gold standard' for assessing resilience (Cosco et al., 2016; Windle et al., 2011). Existing definitions lack precision and fail to account for the multifaceted nature of resilience (Bartley et al., 2019). Resilience factors have been predominantly examined in isolation, overlooking their potentially synergistic and additive effects (Bartley et al., 2019). Consequently, dominant measures reflect trait-like conceptualization of resilience (Cosco et al., 2016; Windle et al., 2011), with a few, more recent tools, attempting to capture its multidimensional nature (Martin et al., 2015a) and none providing a comprehensive basis for measurement. Hence, the need to better understand multiple determinants of resilience and develop assessment tools that would more accurately reflect this knowledge. Such developments would allow health and social care professionals to more precisely distinguish older adults able to adapt after experiencing adversity and enable the development of targeted supports and interventions that address the individual and contextual factors for those who may struggle

(Browne-Yung et al., 2017; Wallace et al., 2001); assisting global efforts to develop sustainable and equitable care systems for our elders (WHO, 2017).

To support this, it appears timely to take stock of existing evidence. Previous reviews explored conceptual foundations of resilience in general populations (Dyer & McGuinness, 1996; Earvolino-Ramirez, 2007) and more specific contexts e.g., in the fields of aging (Cosco et al., 2015), youth mental health (Winders, 2014), or Aboriginal communities (Fleming & Ledogar, 2008). Systematic approaches were used to scrutinize psychometric rigor of resilience scales for general (Windle et al., 2011) and older adult (Cosco et al., 2016) populations. Bolton et al. (2016) offered a qualitative meta-synthesis of protective factors in older adults, while Hicks and Conner (2014) completed a concept analysis of resilient aging. A number of comprehensive reviews focused on resilience in older adults are also available (Fontes & Neri, 2014; MacLeod et al., 2016; Madsen et al., 2019). Lee et al. (2013) applied meta-analytic methodology to identify risk and protective factors related to resilience across the life span. To date, no meta-analytic approach was applied to factors associated with resilience in community-living older adults. Such a review is needed to summarize evidence as, given the contextual nature of resilience (Vanderbilt-Adriance & Shaw., 2008), it seems inappropriate to directly translate these general population-level findings to older adults.

In this systematic review and meta-analysis we examined evidence from quantitative observational studies to identity factors associated with resilience in community-living older adults. We anticipate this knowledge to aid service providers in designing multidimensional interventions aimed at enhancing older adults' resilience and achieve better personal outcomes, while remaining active, independent members of their communities; a flagship policy target internationally (WHO, 2017).

Methods

Protocol and Registration

This systematic review and meta-analysis were conducted in accordance with PRISMA guidelines (see Supplementary Table 1) (Knobloch et al., 2011). The review protocol was registered with PROSPERO: CRD42019162714.

Search strategy

We searched Abstracts in Social Gerontology, CINAHL, MEDLINE, ProQuest Central, PsycINFO and Scopus for English language publications until 13 January 2020. The search string comprised: (resilien* OR coping OR cope OR adapt* OR adjust* OR hardiness) AND (older adult* OR aging OR aging OR aged OR old age OR elderly) AND (community living OR community dwelling OR home OR independent living) AND (protective factor* OR risk factor* OR influencing factor* OR predictor* OR correlate* OR variable* OR demograph* OR resilien* scale). MeSH headings, free text searching, Boolean operators and truncations were used to expand the literature search. No publication date restrictions were applied. Last searches were completed on January 13, 2020.

Records were downloaded into Reference Manager® and screened against inclusion and exclusion criteria. Reference lists of relevant review articles identified through searches as well as articles meeting our pre-defined inclusion criteria were examined for additional publications.

Inclusion and exclusion criteria

Older adults were the population of interest in this review. To allow for different conceptualizations of 'old age' across different countries (WHO, 2019) we set lower age limit at 55. We excluded studies where a mean age and lower 95% confidence interval (CI) was less than 55. Where articles included participants under the age of 55, lower 95% CIs were calculated using the mean age and the standard deviation (SD) of each sample, using the formula $\bar{x}$ -1.96($\sigma/\sqrt{n}$), where $\bar{x}$ is the sample mean, σ is the SD, and n is the sample size (Lane, 2020). Three studies failed to report their samples age as a mean with the SD. King and Richardson (2016) reported the mean age and the age range of their participants. To ensure that this study met the inclusion criteria the SD of the sample mean was estimated using the range rule for SD [σ≈

(b-a)/4, where ‘a’ is the minimum value and ‘b’ is the maximum value (Ramírez & Cox, 2012)]. Calculating the SD then enabled the lower CI for the mean age to be estimated. Similar methods have been reported in previous meta-analyses (e.g., Jotheeswaran et al., 2016; Whitehall et al., 2020). Moore et al. (2015) only reported the mean age of their participants, however they used the same dataset as Jeste et al. (2013) which had a lower 95% CI of 76.55 years. Finally, Scelzo et al. (2018) only reported age ranges of their participants, consequently the lower 95% CI of their samples age could not be calculated. Nevertheless, the decision was made to include their study in this meta-analysis as the reported sample characteristics suggest that the 95% CI for this study would have made it eligible for inclusion (age range: 51-101), and its exclusion may have caused theoretically important information to be lost.

Our focus was on normally aging seniors, with ‘normal aging’ reflecting a biological norm (Canguilhem, 1991). An international review reported that approx. 62% of all the people aged between 65-74 years, and 81.5% of people of ≥85 years live with multiple conditions (Salive, 2013). Therefore, we defined normal aging as aging with a chronic disease (O'Rouke & Ceci, 2013). We excluded studies involving people with dementia as cognitive impairment in dementia deviates from the subtle age-related declines attributed to the process of ‘normal aging’ (e.g., slower thinking, reduced attention) (World Health Organization, 2019). Consequently, the factors associated with the resilience of people with dementia may substantially differ from general community dwelling population of older adults (Christie, 2020). The focus of current policy is to enable older adults to live within their communities for as long as possible (WHO, 2017). We therefore consider factors that shape resilience in community-living populations.

The review included observational studies providing cross-sectional or longitudinal data. Intervention studies were excluded as a pilot database search returned no interventions studies that provided the required data. Only data obtained with the use of standardized resilience measures were included. Based on conceptual underpinnings, these measures were classified as assessing either ‘trait resilience’ or ‘resilience as coping process’ (Supplementary Table 2).

Procedure

Figure 1 outlines the screening profile. Two reviewers (SG & LW) completed title, abstract and full-text screening independently, using structured proforma. Any disagreements were referred to a third researcher (ASR) for resolution. Study quality was assessed by two reviewers independently, using National Heart, Lung and Blood Institute (NIH) Quality Assessment Tool for Observational Cohort and Cross-sectional Studies (NIH, 2020) (Supplementary Table 3). Studies were categorized based on NIH (2020) quality rating into three categories: 'good', 'fair'' or 'poor'. A structured proforma was used for data extraction (Aromataris & Munn, 2020) (Supplementary Table 4). Where multiple articles reported data from the same sample (Jeste et al., 2013; Martin et al., 2015b; Moore et al., 2015; Smith, 2009; Smith, 2012) appropriate effect size measures were included once only. If an article reported data for more than one independent sample (Martin et al., 2015b; Ong et al., 2006; Scelzo et al., 2018; Wagnild, 2003; You & Park, 2017), these were classed as separate studies.

Statistical analysis

Meta-analyses were undertaken to quantitatively synthesize data extracted from studies and consolidate information relating to the factors associated with resilience. A separate meta-analysis was conducted for each factor, using effect sizes based on correlation coefficients between the two continuous variables measuring resilience and the respective factor. Most studies directly reported a correlation coefficient (r). For others, reporting a standardized regression coefficient (β), the corresponding correlation coefficient was imputed using the formula: $r = \beta + 0.05\lambda$; where $-0.50 \leq \beta \leq 0.50$ and β is calculated from a single-equation linear regression model at the individual level; λ is an indicator variable where $\lambda=1$ when $\beta>0$ and $\lambda=0$ when $\beta<0$ (Peterson & Brown, 2005). Fully adjusted regression models were used in the imputation process, except for the study by Liddell and Ferreira (2019), where models were selected on the basis of the specific variables they adjusted for, and preference was given to the model that adjusted for a greater number of variables.

Correlation coefficients extracted for each study were converted to the Fisher's z scale for its variance stabilization and normalization properties, where, $z = 0.5 \ln\left(\frac{1+r}{1-r}\right)$; $SE_z = \sqrt{\frac{1}{n-3}}$ (Borenstein et al., 2009). These transformed values were used to estimate the summary effect size and CI by fitting random-effects models, and the results were back transferred to correlation coefficients. Estimated effect sizes (hereafter 'effect sizes') ≤0.09 were considered negligible, 0.10-0.29 small, 0.30-0.49 medium, and ≥0.50 large (Cohen, 1988). Visual representation of results, via forest plots, displayed the pooled effect size for each factor.

The presence of between-study variation was examined using the χ^2 test for heterogeneity which determines if the observed differences in results are due to random chance (Higgins et al., 2019). The amount of heterogeneity was quantified using the I^2 statistic, which depicts the percentage of variation in estimated effects that is due to actual variation between studies rather than sampling error (Higgins et al., 2003). Leave-one-out sensitivity analysis was performed to further verify consistency and robustness of results obtained, and consequently identify the sources of heterogeneity. Detection of possible publication bias via funnel plots was undertaken, wherein the standard error of estimates were plotted against the estimated effect sizes for each meta-analysis. For factors where at least 10 studies were included in the meta-analysis, funnel plot asymmetry was examined in order to identify the presence of bias (Higgins et al., 2019).

Results

The search of online databases and other sources identified 9,096 publications. Following the screening procedure (Figure 1), 56 articles were identified as meeting inclusion criteria. Among these, 43 papers reported correlational data from 49 independent studies, completed across 10 countries: USA (33), China (2) and Brazil, Germany, Italy, Norway, Sweden, Philippines, Singapore and South Korea (1 each).

Of these, all but two studies (Manning et al., 2016; Silverman et al., 2015) were of cross-sectional design. The majority (24) were of 'fair' quality indicating moderate risk of bias, while 12 demonstrated

'good' (low risk of bias) and seven 'poor' (high risk of bias) quality. Where risk of bias was identified, it was due to methods of sample selection, sample size and its justification, measurement standardization and/or clarity regarding control for confounders. Supplementary Table 5 shows detailed characteristics of studies included in the meta-analysis; Supplementary Table 6 lists the excluded studies.

Measures of resilience

Eight standardized measures of resilience were used across the included studies (Supplementary Table 2). There were five measures of trait resilience, with the Resilience Scale (Wagnild & Young 1993) being utilized most frequently. Six studies used measures of resilience as a coping process, with two each utilizing the Brief Resilience Scale (Smith et al., 2008); Resilience Appraisal Scale (Johnson et al., 2010) and Hardy-Gill Resilience Scale (Hardy et al., 2004).

Factors associated with resilience were categorized into personal and contextual. The complex nature of both resilience and influential factors can make it difficult to assign these factors into distinct categories (Hayman et al., 2017; Ungar, 2013; Vanderbilt-Adriance & Shaw, 2008). For example, loneliness can be conceptualized as an individual's subjective feeling of psychological distress (personal) in response to perceived deficits in the number and quality of one's social relationships (contextual) (Hawkley & Cacioppo, 2010; Yanguas et al., 2018; Matthews et al., 2021). To manage this complexity, for the purpose of this review, we applied criteria similar to those used by Hincks (2014) relative to factors associated with the concept of quality of life. Namely, we defined contextual factors as related to any objective or subjective indicator of the adversity (e.g., perceived stressfulness of the event) or a person's physical, cultural, social and economic environments (e.g., education, discrimination, family/friend network size). In contrast, personal factors relate directly to the individual and reflect their values, beliefs and feelings (e.g., life satisfaction, loneliness), their health and body functions (e.g., frailty, depressive symptoms), and their motor, process and social interaction skills (e.g., cognitive functioning, social engagement).

Studies meeting inclusion criteria

Fifty-six articles met the inclusion criteria. These reported associations between resilience and 48 personal and 23 contextual factors. However, because some factors associations were reported by one study only, and 13 articles reported data not suitable for computing the required effect size, meta-analysis was infeasible for 21 personal and 12 contextual factors. All identified factors and, where relevant, reasons for exclusion from meta-analysis are presented in Supplementary Tables 7-8.

Studies included in meta-analysis

We completed meta-analyses for the identified factors where the available data was supported by measurement reflecting either resilience as a trait or coping process. This resulted in 38 independent meta-analyses (27 personal and 11 contextual factors), based on sample sizes ranging 101-10,809 participants and 2-14 studies. Figure 2 shows a forest plot of the pooled correlation coefficients across studies measuring the association between resilience and each factor. It also shows the number of studies and total sample size across which effect sizes were combined.

Where sufficient data was available we completed a separate analysis based on type of resilience measurement, resulting in 33 meta-analyses across personal and contextual factors for measurement of resilience as a trait and five meta-analyses across personal and contextual factors for resilience measured as a coping process. Figures 3 and 4 show forest plots illustrating these analyses.

Resilience and personal factors

Statistically significant relationships (5% level of significance) were found between resilience and a number of personal factors. Effect sizes ranged from small to large, indicating poor to strong associations between resilience and personal factors.

Personal factors associated with higher resilience

Higher scores on measures of health promoting lifestyle, optimism, purpose in life, self-efficacy, self-transcendence and sense of coherence showed strong (≥0.50) positive associations with resilience, regardless of the conceptual basis behind resilience measure used. Life satisfaction, morale, positive daily

emotions, spirituality, successful aging, self-rated composite health, self-rated mental health, self-rated physical health and physical functioning were also positively related to resilience, regardless of the approach to measurement. These associations were low to moderate ($0.1<r<0.49$). Psychological wellbeing and quality of life both showed positive, moderate associations with resilience. For both factors, due to the low number of studies underpinning the analysis, only a combined analytical approach was possible. Gender was the only socio-demographic factor weakly correlated with trait resilience, suggesting higher trait resilience for females. However, this relationship was not supported by analysis combining data across approaches to measurement or data based on measurement of resilience as a coping process only.

Personal factors associated with lower resilience

Depressive symptoms were moderately, negatively related to resilience regardless of the approach to measurement. Loneliness showed moderate negative associations with resilience in combined analysis as, due to low number of studies, only this approach was possible. Psychological distress was moderately, negatively related to trait resilience. Also based on data reflecting resilience as a trait, risk of suicidal behavior showed a weak, negative association with resilience.

Resilience and contextual factors

A number of contextual factors were significantly associated with resilience (5% level of significance). Estimated effect sizes were predominantly small, indicating low strength of associations. Only one factor reached medium and one large effect size.

Contextual factors associated with higher resilience

Education, income, family/friend network size and social support were all weakly correlated with resilience. The relationship between education and resilience became statistically non-significant when only data based on measurement of resilience as a coping process was considered. Marital status was

weakly associated with trait resilience, but not when data across types of resilience measurement was analyzed together.

Contextual factors associated with lower resilience

Perceived stressfulness of event showed a strong, negative association with resilience. This was based on two studies, representing different conceptual basis for measuring resilience. Experienced stigma was moderately, negatively related to trait resilience.

Factors not significantly associated with resilience

Personal factors showing statistically non-significant associations with resilience, found across types of resilience measurement, include age, gender, Activities of Daily Living (ADL) limitations, cognitive functioning, negative daily emotions and social engagement. Marital status, race, support from family/friends were among contextual factors non-significantly associated with resilience when combined measurement was used in analysis.

Heterogeneity

Table 1 illustrates the measures assessing heterogeneity between studies for each factor – the χ^2 test statistic, Q and its p-value, and the I^2 statistic and its CI.

Since most factors include only a small number of studies and/or limited sample size, a more stringent threshold for statistical significance, $Q_p<0.10$, was considered for the χ^2 test of heterogeneity in order to overcome its issue of low power (Higgins et al., 2019). The test yielded statistically significant variability between studies for the majority of factors, with corresponding I^2 values quantifying this heterogeneity as substantial to considerable (Higgins et al., 2019). In cases where Q_p is ≥ 0.10, CIs for I^2 are usually wide, with $I^2=0$ in some instances.

The leave-one-out sensitivity analysis (Supplementary Table 9) identified a number of studies as influential and potential sources of heterogeneity e.g., Liddell and Ferreira (2019) for factors life satisfaction, self-rated health total and gender; Li et al. (2015) for social support and gender; Lu et al.

(2017) for optimism; and Bartley et al. (2019) for marital status and income. Omission of these studies affected the meta-analyses' results in terms of the heterogeneity statistics, level of significance and the estimated effect size. For factors marital status and gender, upon exclusion of Bartley et al. (2019) and Li et al. (2015) respectively, effect sizes that were initially non-significant changed to small but significant. For income, optimism and social support, effect sizes remained significant but slightly decreased in magnitude, whereas for self-rated health total and life satisfaction they remained significant but slightly increased in magnitude when influential studies were omitted. More substantial changes were observed for between-study heterogeneity, wherein the I^2 statistic considerably reduced in most cases on removal of these influential studies. Potential sources of heterogeneity linked to the studies identified as influential include a) methodology applied to the computation of the effect size; b) variations in conceptual basis behind the resilience measures used; c) use of non-standardized tools in measurement of continuous variables associated with resilience; c) use of diverse coding for categorical variables associated with resilience; e) participants' characteristics, including cultural diversity between analyzed samples, focus on older adults living with a specific health condition or those living in post-disaster communities.

Publication bias

Funnel plots offering visualization of the bias analysis for factors with at least 10 studies are presented in Supplementary Figures 10a-e. Funnel plot asymmetry was substantially noted for factors self-rated health (total, physical and mental), wherein smaller studies without statistically significant effects were likely unreported, causing gaps in the bottom corners of the plots. Possibility of bias was also detected for factors age and depressive symptoms, where several studies were outside the 95% confidence region based on a random-effects meta-analysis.

Discussion

To our knowledge, this is the first systematic review with meta-analyses of factors associated with resilience in community-living older adults. It is also the first such review including measures of

resilience as a trait and coping process, and to explicitly consider both personal and contextual factors associated with resilience. The majority of the included studies were cross-sectional, with substantial to considerable between-study heterogeneity. Most studies demonstrated moderate to high risk of bias. From a broad range of factors identified as being related to resilience, about 50% were supported by evidence sufficient to facilitate meta-analysis. Where meta-analysis was possible, a number of personal and contextual factors were significantly related to resilience, with most showing weak to moderate and a few reaching strong associations. Where strong associations were found, CIs were typically wide. Only 13 of 38 meta-analyses were supported by data from more than three studies.

Amongst socio-demographic factors, age and race were unrelated to resilience. Gender, education, income and marital status showed weak but inconsistent associations, depending on the type of resilience measurement. Our observations relative to relationships between socio-demographic factors and resilience resonates with previous meta-analytical review, which highlighted inconsistency of findings and relatively low effect of these factors on resilience when compared with the effect of other psychosocial influences (Lee et al., 2013).

In this meta-analysis, factors indicative of physical and psychological wellbeing were generally associated with higher resilience, as were those reflecting access to and quality of social support. The majority of these relationships were weak to moderate, with only a few personal factors demonstrating strong associations, including health promoting lifestyle, optimism, purpose in life, self-efficacy, self-transcendence and sense of coherence. This is consistent with findings of systematic reviews which sought to synthesize available data about older adults protective factors (Bolton et al., 2016; Earvolino-Ramirez, 2007; Resnick, 2011), as well as with other meta-analyses which investigated factors associated with resilience in different populations (Lee et al., 2013 (adults); Yule et al., 2019 (children exposed to violence)).

We found that a number of personal factors (loneliness, depression, and psychological distress) were moderately associated with lower resilience. Additionally, two contextual factors (perceived stressfulness of the event and experience of stigma) showed similar patterns of association. Loneliness,

depression and psychological distress have previously been reported as being associated with lower resilience in older adults (Clark et al., 2018; Mlinac et al., 2011), as well as in other populations (Chai et al., 2019 (left-behind children); Iacob et al., 2020 (familial caregivers); Lee et al., 2013 (adults)). Higher perceived stressfulness of the event has also previously been identified as being associated with lower resilience (Hye Kyung et al., 2017 (nurses); Lee et al., 2013 (adults)). However, our finding of experience of stigma being associated with lower resilience is relatively novel, although Hayman et al. (2017) suggest that a stigma of aging may negatively affect resilience.

Due to limited longitudinal data, we were unable to consider the role of the identified factors as predictors of resilience. Moreover, we recognize that the effect of relationships between resilience and some socio-demographic and psychosocial factors may vary depending on the approach to the measurement of resilience, as we found that the relationships between resilience and gender, marital status and education differed based on the approach to measurement. This supports the notion that resilience results from complex associations across many domains, which may co-vary in different combinations to influence individual results (Bartley et al., 2019; Dahlberg, 2015; Southwick et al., 2014). It may also reflect a theory that health outcomes, including resilience, are influenced by many factors operating on many levels, and that this impact may vary over time and context (Hayman et al., 2017; Orford, 2008).

The importance of a range of personal and contextual factors relative to resilience have been identified in a previous meta-analysis focused on resilience across the lifespan (Lee et al., 2013). Our review identified a number of additional factors e.g., spirituality, purpose in life, self-rated physical and mental health, which were not identified by Lee et al. (2013). But, for some factors, previously recognized as important e.g., self-esteem, negative affect or anxiety (Lee et al., 2013), due to insufficient data, we were unable to complete meta-analysis. This too aligns with the notion of the contextual nature of resilience (Vanderbilt-Adriance & Shaw, 2008), indicating that factors associated with resilience may change over the life-span, supporting the need for a better understanding of its contextual determinants (Hayman et al., 2017). Consideration of our findings in the context of previous qualitative and

comprehensive reviews highlights that a number of potentially important factors e.g., previous experience of hardship (Bolton et al., 2016; Hicks & Conner, 2016), altruism (Bolton et al., 2016) or cultural dimensions (Fleming & Ledogar, 2008), have not been quantitatively evaluated in older adults or, as shown in this review, there is insufficient quantitative data to support meta-analysis. This indicates that associations examined in quantitative studies to-date, and certainly those captured in this meta-analysis, are unlikely to reflect all factors that are critical to understanding and supporting development of interventions aiming to promote resilience in older adults.

Studies included in our review employed numerous standardized measures of resilience, with the Resilience Scale (Wagnild & Young, 1993) being utilized most frequently. Previous reviews considered the measurement of resilience in adult (Windle et al., 2011) and older adult (Cosco et al., 2016) populations. Windle et al. (2011) highlights that despite wide recognition of resilience as being associated with personal and contextual factors, the vast majority of resilience tools capture only its individual domains. The same was acknowledged by Cosco et al. (2016) relative to tools used to assess resilience in older adults. Windle et al. (2011) recommends that, to facilitate development of effective interventions, resilience measures should reflect a multi-level perspective that spans across personal and contextual determinants. However, although new tools, reportedly meeting this criterion (e.g., Martin et al., 2015a), have been developed in the context of community dwelling older adults, they neither capture all important aspects of resilience nor have established properties of validity and reliability. And, as we reflect, are not widely used in research.

Due to scarcity of evidence, we took a decision to statistically analyze all factors for which data was available from two or more studies. Consequently, the number of studies included in each meta-analysis is generally small, with 77% including fewer than five studies. This approach allowed consideration of a wider range of factors than would be possible if we applied more stringent selection criteria. However, it affected the robustness of the average population effect size and average sampling error calculated. Lack of a substantial number of studies also affects the estimation of between study variance since it causes the $\chi 2$ test to have low power and uncertainty in the value of I^2 i.e., wider CIs.

Moreover, inconsistent reporting of demographic data across included studies prevented meta-regression or subgroup analyses, meaning additional potential sources of heterogeneity could not be considered. For some studies, we had to impute the effect size, which further affected the accuracy of the analysis. Additionally, due to the nature of underlying data, we examined factors separately and could not account for likely inter-correlations. Finally, the completed publication bias analysis indicated the possibility of reporting biases which are likely to result in overestimation of effect estimates. In this context, publication of high-quality research on resilience in older adults, inclusive of negative findings, should be encouraged to facilitate more accurate evaluation of evidence.

Our findings highlight some limitations relative to the lack of consistency in defining, conceptualizing and measuring resilience in older adults i.e., we identified that the relationship between influential factors and resilience may vary depending on how resilience is measured. Although current conceptualizations emphasize the multidimensionality and dynamic nature of resilience (Liu et al., 2017), the prevailing approaches to the study of resilience fail to account for these characteristics (Bartley et al., 2019). Consequently, most established measures do not capture all relevant factors (Windle et al., 2011; Cosco et al., 2016) and none can serve as a 'gold standard' for resilience assessment (Windle et al., 2011; MacLeod et al., 2016). This is important, as inaccurate measurement may provide misleading information, affecting accuracy of research and clinical recommendations (Cosco et al., 2016; Hayman et al., 2017). Therefore, broadening the perspective to include a range of personal and contextual factors, conceptualized from different levels and reflecting both protective and risk factors, is likely to provide a greater understanding and basis for measurement of resilience. We concur with Bartley et al. (2019) that incorporating additional dimensions, reflecting health and lifestyle as well as a broader range of psychological and contextual factors, will be key to improving the understanding, assessment and design of interventions to promote resilience in older adults. Such comprehensive consideration of resilience may also contribute to models of healthy aging as, through the addition of adversity and resilience to the healthy aging model, the concept becomes more appropriate for the aging population who are likely to experience a range of adversities (Cosco et al., 2017). A greater understanding of the influence of

contextual factors on resilience may also support the design of environments and health systems that support healthy aging, through identifying social and community factors which support an individual's ability to adapt well in the face of age-related adversities (Earvolino-Ramirez, 2007; Hicks & Conner, 2014; Hayman et al., 2017; Wong, 2018).

Improvements in this area will be of particular importance in the aftermath of COVID-19 pandemic, which disproportionately affects older adults' ability to navigate through and adapt to age-related and societal challenges we all experience as a result (Harkins, 2020; UN, 2020). It has been reported that, during the pandemic, resilience has moderated the relationship between stress and mental health outcomes (Havnen et al., 2020). However, preliminary research (Mental Health Foundation, 2020; Wister & Speechley, 2020) has also found that the pandemic has caused an increase in vulnerability factors (e.g., poor health, decreased social support and social engagement, reduced access to community services, increased social isolation and loneliness, worsening psychological and economic resources, and harmful coping strategies), which may have a detrimental influence on individuals' resilience. At the same time, many protective factors (e.g., social engagement, contact with friends and family, income and physical activity) have been negatively impacted by the pandemic, particularly for older adults (Mental Health Foundation, 2020; Wister & Speechley, 2020). Consequently, innovative ways to bolster older adults' resilience are needed (Fuller & Huseth-Zosel, 2021; Wister & Speechley, 2020); especially as it is recognized that the impact of the COVID-19 pandemic is likely to be long-lasting (The British Academy, 2021). Supporting the protective factors and identifying and addressing the vulnerability factors of older adults will be crucial as they face the continuing consequences of the pandemic (Wister & Speechley, 2020).

Conclusion

This review highlighted limitations in prevailing ways of conceptualizing and assessing resilience, which may impede how services support older adults. Our findings support the need for conceptualization and measurement of resilience that would incorporate a broader range of personal and contextual dimensions,

considered at different levels, and reflecting health and lifestyle as well as psychological and contextual factors. Additionally, there is a need for longitudinal research to reflect these changes, inform development of multidimensional interventions to promote resilience, and support identification of older adults who may benefit from a timely provision of preventative measures.

References

References marked with an asterisk indicate studies included in the meta-analysis.

Aromataris, E, & Munn, Z. (2020). *JBI Manual for Evidence Synthesis*. https://synthesismanual.jbi.global. doi: 10.46658/JBIMES-20-01

* Bartley, E. J., Palit, S., Fillingim, R. B., & Robinson, M. E. (2019). Multisystem resiliency as a predictor of physical and psychological functioning in older adults with chronic low back pain. *Frontiers in Psychology*, *10*, 1932. doi: 10.3389/fpsyg.2019.01932

Block, J. H. & Block, J. (1982). The role of ego-control and ego resiliency in the organization of behavior. In W.A. Collins (Ed.), *Minnesota Symposium on Child Psychology* (1st ed., pp. 39-101). Psychology Press.

Bolton, K. W., Praetorius, R. T., & Smith-Osborne, A. (2016). Resilience protective factors in an older adult population: A qualitative interpretive meta-synthesis. *Social Work Research*, *40*(3), 171-182. doi: 10.1093/swr/svw008

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to Meta-Analysis*. John Wiley & Sons.

Browne-Yung, K., Walker, R. B., & Luszcz, M. A. (2017). An Examination of Resilience and Coping in the Oldest Old Using Life Narrative Method. *The Gerontologist*, *57*(2), 282-291. doi: 10.1093/geront/gnv137

Canguilhem, G. (1991). *The normal and the pathological*. Zone Books.

Chai, X., Du, H., Li, X., Su, S., & Lin, D. (2019). What Really Matters for Loneliness Among Left-Behind Children in Rural China: A Meta-Analytic Review. *Frontiers in Psychology, 10.* doi: 10.3389/fpsyg.2019.00774

Christie, J. (2020). *Promoting Resilience in Dementia Care*. Jessica Kingsley Publishers.

Clark, P. G., Burbank, P. M., Greene, G., Owens, N., & Riebe, D. (2018). What do we know about resilience in older adults? An exploration of some facts, factors, and facets. In B. Resnick, L.P. Gwyther & K.A. Roberto (Eds.), *Resilience in Aging Concepts, Research and Outcomes* (pp. 51-66). Springer.

Clark, P. G., Greene, G. W., Blissmer, B. J., Lees, F. D., Riebe, D. A., & Stamm, K. E. (2019). Trajectories of maintenance and resilience in healthful eating and exercise behaviors in older adults. *Journal of Aging and Health*, *31*(5), 861-882. doi: 10.1177/0898264317746264

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Lawrence Earlbaum Associates.

Cosco, T. D., Kaushal, A., Cooper, R., Richards, M., Hardy, R., Kuh, D., & Stafford, M. (2015). The operationalisation of resilience in aging: a systematic review. *The Lancet*, *386*(S32). doi: 10.1016/S0140-6736(15)00870-3

Cosco, T. D., Kaushal, A., Richards, M., Kuh, D., & Stafford, M. (2016). Resilience measurement in later life: a systematic review and psychometric analysis. *Health and Quality of Life Outcomes*, *14*(1), 16. doi: 10.1186/s12955-016-0418-6

Cosco, T. D., Howse, K., & Brayne, C. (2017). Healthy ageing, resilience and wellbeing. *Epidemiology and Psychiatric Sciences*, *26*, 579–583. doi: 10.1017/S2045796017000324

Dahlberg, R. (2015). Resilience and complexity: Conjoining the discourses of two contested concepts. *Culture Unbound*, *7*(3), 541-557. doi: 10.3384/cu.2000.1525.1572541

Dugarova, E. (2017). *Aging, older persons and the 2030 Agenda for Sustainable Development*. United Nations Development Programme.

Dyer, J. G., & McGuinness, T. M. (1996). Resilience: Analysis of the concept. *Archives of Psychiatric Nursing*, *10*(5), 276-282. doi: 10.1016/s0883-9417(96)80036-7

Earvolino-Ramirez, M. (2007). Resilience: A concept analysis. *Nursing forum*, *42*(2), 73-82. doi: 10.1111/j.1744-6198.2007.00070.x

Fleming, J., & Ledogar, R. J. (2008). Resilience, an evolving concept: A review of literature relevant to Aboriginal research. *Pimatisiwin*, *6*(2), 7.

Fontes, A. P., & Neri, A. L. (2015). Resilience in aging: literature review. *Ciencia & Saude Coletiva*, *20*, 1475-1495. doi: 10.1590/1413-81232015205.00502014

* Fullen, M. C., Richardson, V. E., & Granello, D. H. (2018). Comparing successful aging, resilience, and holistic wellness as predictors of the good life. *Educational Gerontology*, *44*(7), 459-468. doi: 10.1080/03601277.2018.1501230

Fuller, H. R., & Huseth-Zosel, A. (2021). Lessons in resilience: initial coping among older adults during the COVID-19 pandemic. *The Gerontologist*, *61*(1), 114-125. doi: 10.1093/geront/gnaa170

Havnen, A., Anyan, F., Hjemdal, O., Solem, S., Gurigard Riksfjord, M., & Hagen, K. (2020). Resilience Moderates Negative Outcome from Stress during the COVID-19 Pandemic: A Moderated-Mediation Approach. *International Journal of Environmental Research and Public Health*, *17*(18), 6461. doi: 10.3390/ijerph17186461

Hawkley, L. C., & Cacioppo, F. T. (2010). Loneliness Matters: A Theoretical and Empirical Review of Consequences and Mechanisms. *Annals of Behavioral Medicine*, *40*(2). doi: 10.1007/s12160-010-9210-8.

Hayman, K. J., Kerse, N., & Consedine, N. S. (2017). Resilience in context: the special case of advanced age. *Aging & Mental Health*, *21*(6), 577-585. doi: 10.1080/13607863.2016.1196336

* Hardy, S. E., Concato, J., & Gill, T. M. (2004). Resilience of community-dwelling older persons. *Journal of the American Geriatrics Society*, *52*(2), 257-262. doi: 10.1111/j.1532-5415.2004.52065.x

Harkins, C. (2020, May). *Supporting community recovery and resilience in response to the COVID-19 pandemic*.

https://www.gcph.co.uk/publications/938_supporting_community_recovery_and_resilience_in_response_to_covid-19

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (2019, July). *Cochrane Handbook for Systematic Reviews of Interventions version 6.0*. https://training.cochrane.org/cochrane-handbook-systematic-reviews-interventions

Higgins, J. P. T., Thompson, S. G., Deeks, J. J. & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, *327*, 557–560. doi: 10.1136/bmj.327.7414.557

Hicks, M. M., & Conner, N. E. (2014). Resilient aging: A concept analysis. *Journal of Advanced Nursing*, *70*(4), 744-755. doi: 10.1111/jan.12226

Hye Kyung, K., Sin Hyang, K., & Si Hyun, P. (2017). A Meta-Analysis of the Correlates of Resilience in Korean Nurses. *Journal of Korean Clinical Nursing Research*, *23*(1), 100-109. doi: 10.22650/JKCNR.2017.23.1.100

Iacob, C. R., Avram, E., Cojocaru, D., & Podina, I. R. (2020). Resilience in Familial Caregivers of Children with Developmental Disabilities: A Meta-analysis. *Journal of Autism and Developmental Disorders, 50,* 4053-4068. doi: 10.1007/s10803-020-04473-9

Jeste, D. V., Savla, G. N., Thompson, W. K., Vahia, I. V., Glorioso, D. K., Martin, A. V. S., ... & Depp, C. A. (2013). Association between older age and more successful aging: critical role of resilience and depression. *American Journal of Psychiatry*, *170*(2), 188-196. doi: 10.1176/appi.ajp.2012.12030386

Johnson, J., Gooding, P. A., Wood, A. M., & Tarrier, N. (2010). Resilience as positive coping appraisals: Testing the schematic appraisals model of suicide (SAMS). *Behaviour Research and Therapy*, *48*(3), 179-186. doi: 10.1016/j.brat.2009.10.007

Jotheeswaran, A. T., Lovakanth, N., Nadiga, S., Anchala, R., Murthy, S., & Gilbert, C. E. (2016). Estimating the proportion of persons with diabetes developing diabetic retinopathy in India: A systematic review and meta-analysis. *Indian Journal of Endocrinology and Metabolism, 20*(Suppl 1), S51-S58. doi: 10.4103/2230-8210.179774

Knobloch, K., Yoon, U., & Vogt, P. (2011). Preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement and publication bias. *Journal of Cranio-Maxillofacial Surgery*, *39*(2), 91-92. doi: 10.1016/j.jcms.2010.11.001

* Lamond, A. J., Depp, C. A., Allison, M., Langer, R., Reichstadt, J., Moore, D. J., … Jeste, D. V. (2008). Measurement and predictors of resilience among community-dwelling older women. *Journal of Psychiatric Research*, *43*(2), 148-154. doi: 10.1016/j.jpsychires.2008.03.007

Lane, D. M. (2020). *Online Statistics Education: A Multimedia Course of Study*. http://onlinestatbook.com/.

Lazarus, R. S. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology*, *44*(1), 1-22. doi: 10.1146/annurev.ps.44.020193.000245

Lee, J. H., Nam, S. K., Kim, A. R., Kim, B., Lee, M. Y., & Lee, S. M. (2013). Resilience: a meta-analytic approach. *Journal of Counselling & Development*, *91*(3), 269-279. doi: 10.1002/j.1556-6676.2013.00095.x

* Li, J., Theng, Y. L., & Foo, S. (2015). Depression and psychosocial risk factors among community-dwelling older adults in Singapore. *Journal of Cross-cultural Gerontology*, *30*(4), 409-422. doi: 10.1007/s10823-015-9272-y

* Liddell, J., & Ferreira, R.J. (2019). Predictors of Individual resilience characteristics among individuals ages 65 and older in post-disaster settings. *Disaster Medicine and Public Health Preparedness*, *13*(2), 256-264. doi: 10.1017/dmp.2018.52

Liu, J. J., Reed, M., & Girard, T. A. (2017). Advancing resilience: An integrative, multi-system model of resilience. *Personality and Individual Differences*, *111*, 111-118. doi: 10.1016/j.paid.2017.02.007

* Lu, C., Yuan, L., Lin, W., Zhou, Y., & Pan, S. (2017). Depression and resilience mediates the effect of family function on quality of life of the elderly. *Archives of Gerontology and Geriatrics*, *71*, 34-42. doi: 10.1016/j.archger.2017.02.011

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, *71*, 543-562. doi: 10.1111/1467-8624.00164

MacLeod, S., Musich, S., Hawkins, K., Alsgaard, K., & Wicker, E. R. (2016). The impact of resilience among older adults. *Geriatric Nursing*, *37*(4), 266-272. doi: 10.1016/j.gerinurse.2016.02.014

Madsen, W., Ambrens, M., & Ohl, M. (2019). Enhancing resilience in community-dwelling older adults: a rapid review of the evidence and implications for public health practitioners. *Frontiers in Public Health*, *7*, 14. doi: 10.3389/fpubh.2019.00014

* Manning, L.K., Carr, D.C., & Kail, B.L. (2016). Do higher levels of resilience buffer the deleterious impact of chronic illness on disability in later life? *The Gerontologist*, *56*(3), 514-524. doi: 10.1093/geront/gnu068

Martin, A. V. S., Distelberg, B., Palmer, B. W., & Jeste, D. V. (2015a). Development of a new multidimensional individual and interpersonal resilience measure for older adults. *Aging & Mental Health*, *19*(1), 32-45. doi: 10.1080/13607863.2014.909383

Martin, A. S., Palmer, B. W., Rock, D., Gelston, C.V., & Jeste, D.V. (2015b). Associations of self-perceived successful aging in young-old versus old-old adults. *International Psychogeriatrics*, *27*(4), 601-609. doi: 10.1017/S104161021400221X

Matthews, T., Fisher, H. L., Bryan, B. T., Danese, A., Moffitt, T. E., Qualter, P., Verity, L. & Arseneault, L. (2021). This is what loneliness looks like: A mixed methods study of loneliness in adolescence and young adulthood. *International Journal of Behavioral Development*, 1-10. doi: 10.1177/0165025420979357

Mental Health Foundation. (2020). *Resilience across the UK during the coronavirus pandemic*. https://www.mentalhealth.org.uk/coronavirus/resilience-across-uk-coronavirus-pandemic

Mlinac, M. E., Sheeran, T. H., Blissmer, B., Lees, F, & Martins, D. (2011). Psychological Resilience. In B. Resnick, L.P. Gwyther & K.A. Roberto (Eds.), *Resilience in Aging Concepts, Research and Outcomes* (pp. 67-87). Springer.

* Moore, R. C., Eyler, L. T., Mausbach, B. T., Zlatar, Z. Z., Thompson, W. K., Peavy, G., … Jeste, D. V. (2015). Complex interplay between health and successful aging: role of perceived stress, resilience, and social support. *The American Journal of Geriatric Psychiatry*, *23*(6), 622-632. doi: 10.1016/j.jagp.2014.08.004

NIH. (2020). *Study Quality Assessment Tools: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studie*s. https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools

* Ong, A. D., Bergeman, C. S., Bisconti, T. L., & Wallace, K. A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of Personality and Social Psychology*, *91*(4), 730-749. doi: 10.1037/0022-3514.91.4.730

Ong, A. D., Bergeman, C. S., & Boker, S. M. (2009). Resilience comes of age: Defining features in later adulthood. *Journal of Personality*, *77*(6), 1777-1804. doi: 10.1111/j.1467-6494.2009.00600.x

Orford, J. (2008). *Community psychology: Challenges, controversies and emerging consensus*. John Wiley & Sons Ltd.

O'Rourke, H. M., & Ceci, C. (2013). Reexamining the boundaries of the 'normal' in aging. *Nursing Inquiry*, *20*, 51-59. doi: 10.1111/j.1440-1800.2011.00583.x

Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology*, *90*, 175–181. doi: 10.1037/0021-9010.90.1.175

Ramirez, A., & Cox, C. (2012). Improving on the Range Rule of Thumb. *Rose-Hulman Undergraduate Mathematics*, *13*(2).

Resnick. B. (2011). The Relationship between Resilience and Motivation. In B. Resnick, L.P. Gwyther, & K.A. Roberto (Eds), *Resilience in Ageing: Concepts, Research, and Outcomes* (pp. 199-215). Springer.

Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. *The British Journal of Psychiatry*, *147*(6), 598-611. doi: 10.1192/bjp.147.6.598

Salive, M. E. (2013). Multimorbidity in older adults. *Epidemiologic Reviews*, *35*, 75-83. doi: 10.1093/epirev/mxs009

* Scelzo, A., Di Somma, S., Antonini, P., Montross, L. P., Schork, N., Brenner, D., & Jeste, D. V. (2018). Mixed-methods quantitative–qualitative study of 29 nonagenarians and centenarians in rural Southern Italy: focus on positive psychological traits. *International Psychogeriatrics*, *30*, 31-38. doi: 10.1017/S1041610217002721

* Silverman, A. M., Molton, I. R., Alschuler, K. N., Ehde, D.M., & Jensen, M.P. (2015). Resilience predicts functional outcomes in people aging with disability: A longitudinal investigation. *Archives of Physical Medicine and Rehabilitation*, *96*(7), 1262-1268. doi: 10.1016/j.apmr.2015.02.023

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International Journal of Behavioral Medicine*, *15*(3), 194-200. doi: 10.1080/10705500802222972

* Smith, P. R. (2009). Resilience: resistance factor for depressive symptom. *Journal of Psychiatric and Mental Health Nursing*, *16*, 829-837. doi: 10.1111/j.1365-2850.2009.01463.x

* Smith, P. R. (2012). Resilience and stigma influence older African Americans seeking care. *ABNF Journal*, *23*(4), 85-93.

Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience definitions, theory, and challenges: interdisciplinary perspectives. *European Journal of Psychotraumatology*, *5*(1), 25338. doi: 10.3402/ejpt.v5.25338

Storey, A. (2018, August 13). *Living longer—how our population is changing and why it matters*. https://www.ons.gov.uk/releases/livinglongerhowourpopulationischangingandwhyitmatters

The British Academy. (2021). *The COVID Decade: understanding the long-term societal impacts of COVID-19*. http://www.thebritishacademy.ac.uk/publications/covid-decade-understanding-the-long-term-societal-impacts-of-covid-19/

Ungar, M. (2013) Resilience, Trauma, Context, and Culture. *Trauma, Violence. & Abuse*, *14*(3), 255-266. doi: 10.1177/1524838013487805

United Nations. (2019, June 17). *World Population Prospects 2019: Highlights*. https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html

United Nations. (2020). *Policy Brief: The Impact of COVID-19 on older persons*. https://www.un.org/development/desa/ageing/news/2020/05/covid-19-older-persons/

Vanderbilt-Adriance, E., & Shaw, D. S. (2008). Conceptualizing and re-evaluating resilience across levels of risk, time, and domains of competence. *Clinical Child and Family Psychology Review*, *11*(1-2), 30-58. doi: 10.1007/s10567-008-0031-2

* Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement*, *1*(2), 165-178.

* Wagnild, G. (2003). Resilience and successful aging: Comparison among low and high income older adults. *Journal of Gerontological Nursing*, *29*(12), 42-49. doi: 10.3928/0098-9134-20031201-09

* Wallace, K. A., Bisconti, T. L., & Bergeman, C.S. (2001). The mediational effect of hardiness on social support and optimal outcomes in later life. *Basic and applied social psychology*, *23*(4), 267-276. doi: 10.1207/s15324834basp2304_3

Whitehall, L., Rush, R., Górska, S., & Forsyth, K. (2020). The general self-efficacy of older adults receiving care: A systematic review and meta-analysis. *The Gerontologist*, 1-16. doi: 10.1093/geront/gnaa036/5830934

Winders, S. J. (2014). From extraordinary invulnerability to ordinary magic: A literature review of resilience. *Journal of European Psychology Students*, *5*(1), 3-9. doi: 10.5334/jeps.bk

Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes*, *9*(1), 8. doi: 10.1186/1477-7525-9-8

Wister, A., & Speechley, M. (2020). COVID-19: Pandemic risk, resilience and possibilities for aging research. *Canadian Journal on Aging*, *39*(3), 344-347. doi: 10.1017/S0714980820000215

Wong, R. Y. (2018). A new strategic approach to successful aging and healthy aging. *Geriatrics*, *3*(86). doi: 10.3390/geriatrics3040086

World Health Organization. (2002). *Proposed working definition of an older person in Africa for the MDS Project*. https://www.who.int/healthinfo/survey/agingdefnolder/en/

World Health Organization. (2015, September 30). *World report on aging and health*. https://www.who.int/aging/events/world-report-2015-launch/en/

World Health Organization. (2017). *Global strategy and action plan on aging and health*. https://www.who.int/aging/global-strategy/en/

World Health Organization. (2018, February 5). *Aging and health*. https://www.who.int/news-room/fact-sheets/detail/aging-and-health

World Health Organization. (2019). *Risk Reduction of Cognitive Decline and Dementia: WHO Guidelines*. https://www.who.int/mental_health/neurology/dementia/guidelines_risk_reduction/en/

Yanguas, J., Pinazo-Henandis, S., & Tarazona-Santabalbina, F. J. (2018). The complexity of loneliness. *Acta Biomedica*, *89*(2), 302-314. doi: 10.23750/abm.v89i2.7404

* You, S., & Park, M. (2017). Resilience protected against suicidal behavior for men but not women in a community sample of older adults in Korea. *Frontiers in Psychology*, *8*, 401. doi: 10.3389/fpsyg.2017.00401

Yule, K., Houston, J., & Grych, J. (2019). Resilience in Children Exposed to Violence: A Meta-analysis of Protective Factors across Ecological Contexts. *Clinical Child and Family Psychology Review*, *22*, 406-431. doi: 10.1007/s10567-019-00293-1

Ziglio, E. (2017). *Strengthening resilience: A priority shared by health 2020 and the sustainable development goals*. https://www.euro.who.int/en/countries/monaco/publications/strengthening-resilience-a-priority-shared-by-health-2020-and-the-sustainable-development-goals-2017

Figure 1: Study screening profile

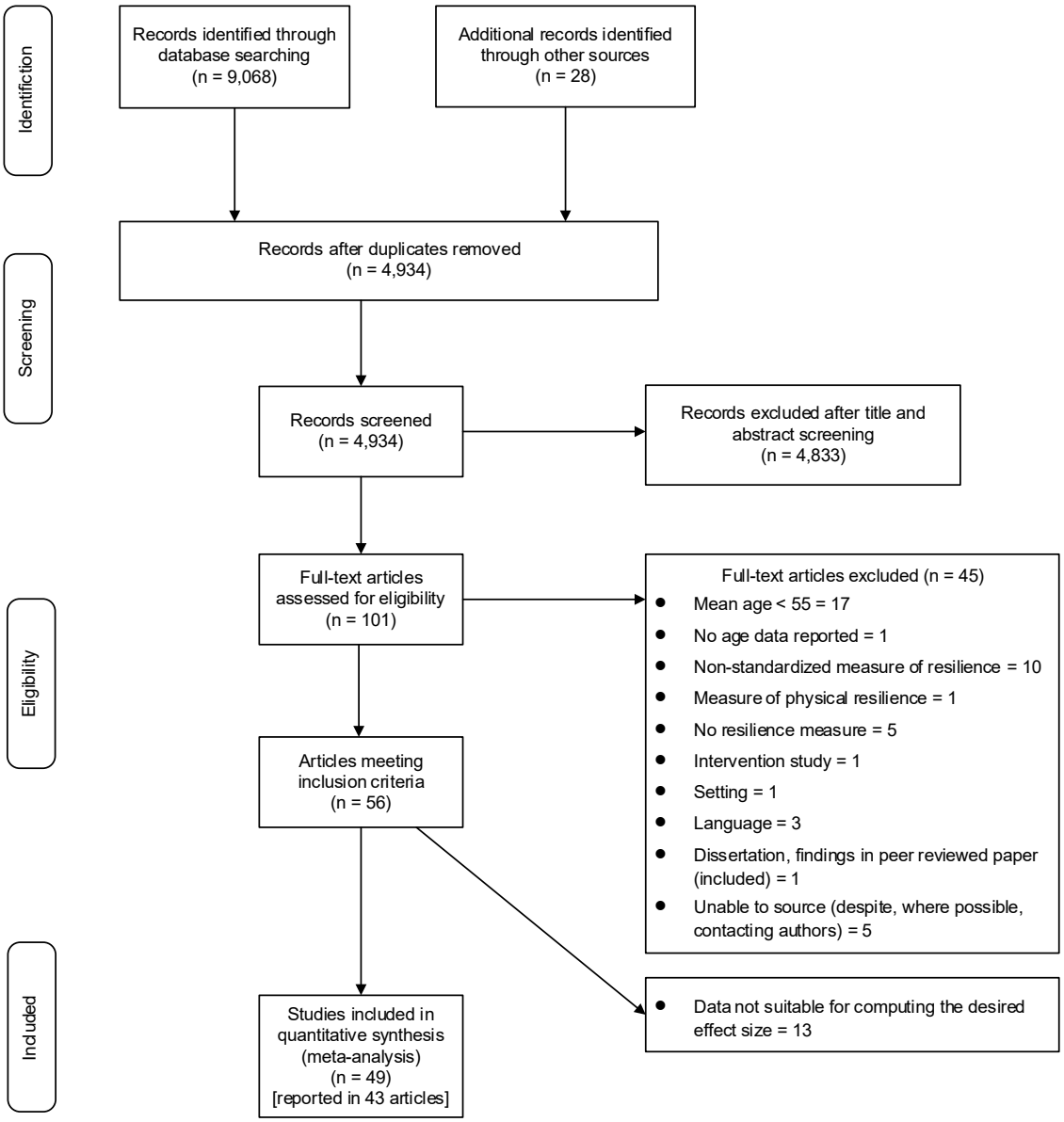


Figure 2: Forest plot showing estimated correlation coefficients between personal and contextual factors and resilience (combined measurement of resilience as trait and as coping process). Note: positive scores indicate that factors were related to higher resilience, negative scores indicate that factors were related to lower resilience.

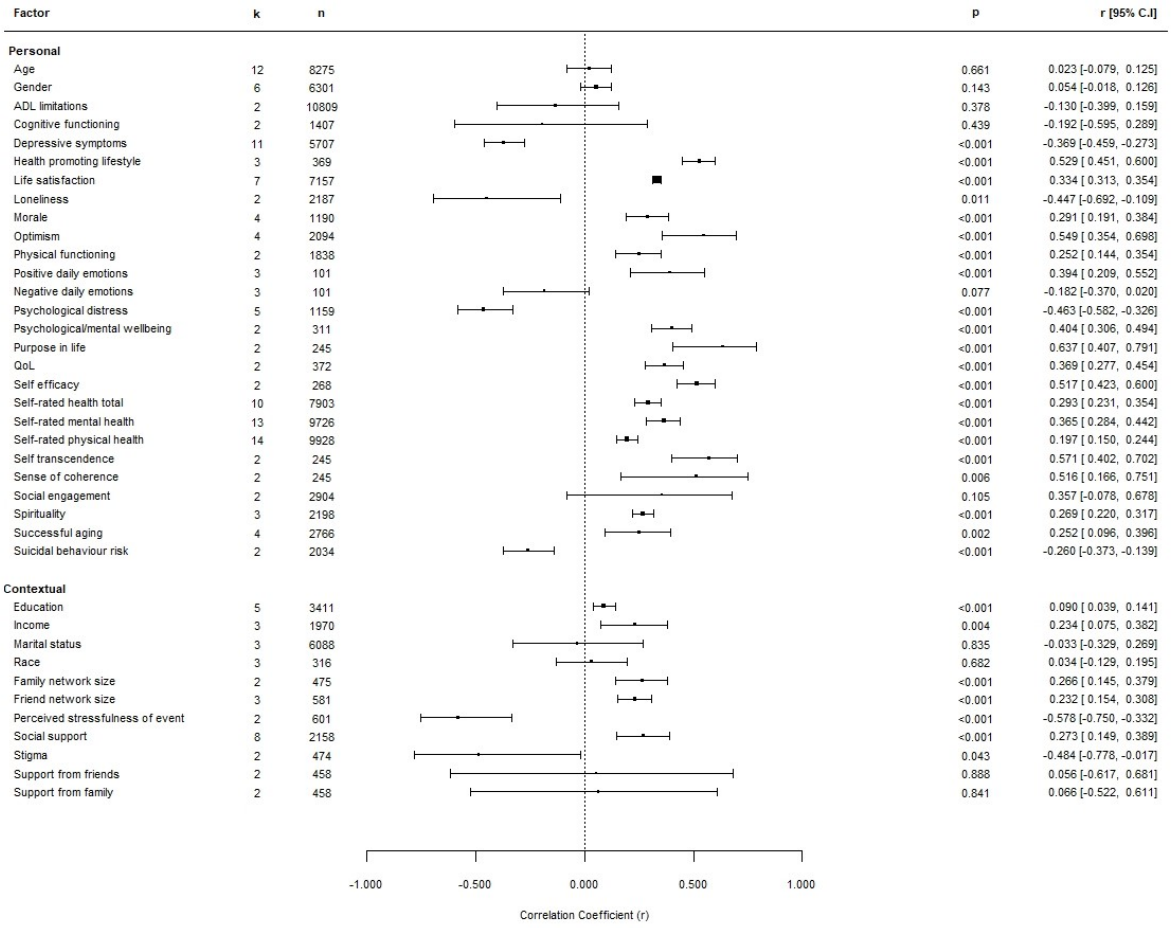


Figure 3: Forest plot showing estimated correlation coefficients between personal and contextual factors and trait resilience. Note: positive scores indicate that factors were related to higher resilience, negative scores indicate that factors were related to lower resilience.

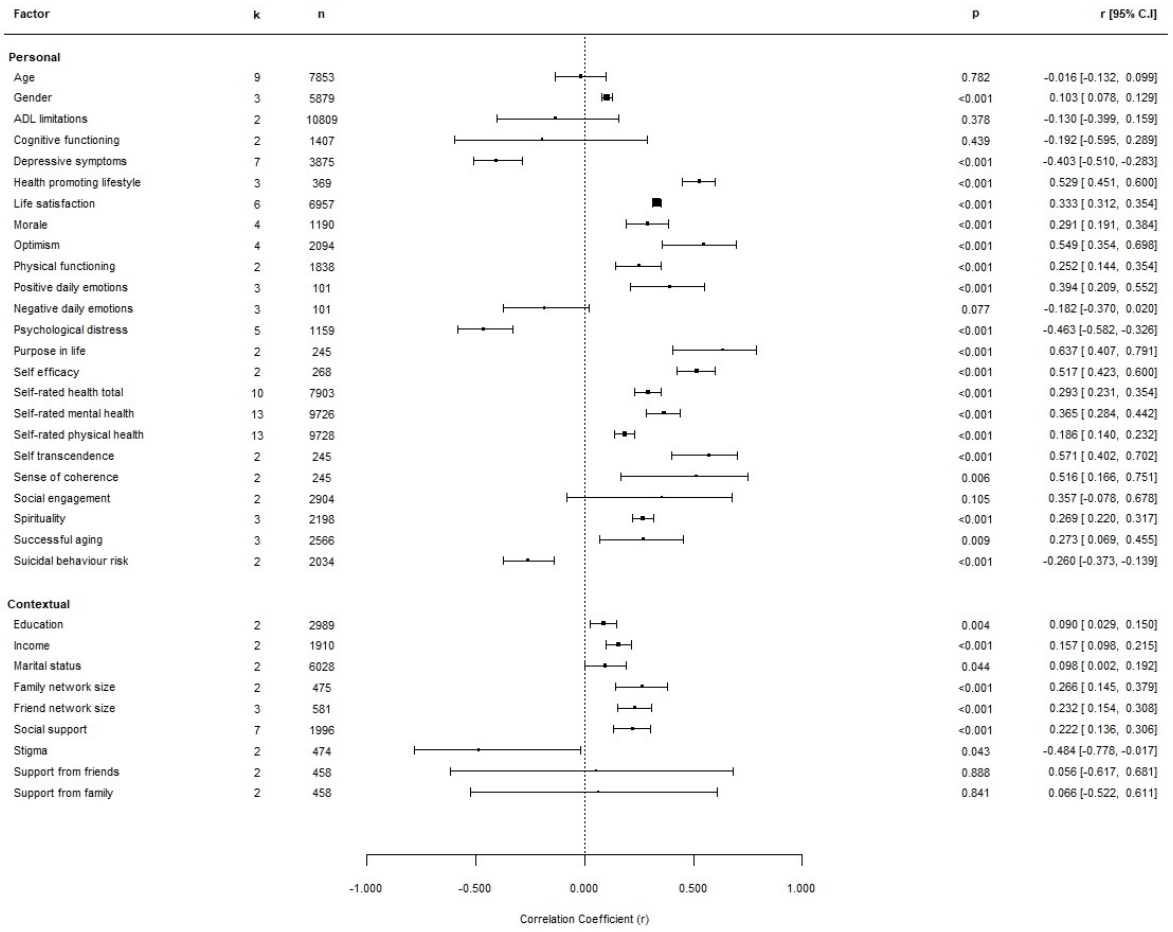


Figure 4: Forest plot showing estimated correlation coefficients between personal and contextual factors and resilience as coping process. Note: positive scores indicate that factors were related to higher resilience, negative scores indicate that factors were related to lower resilience.

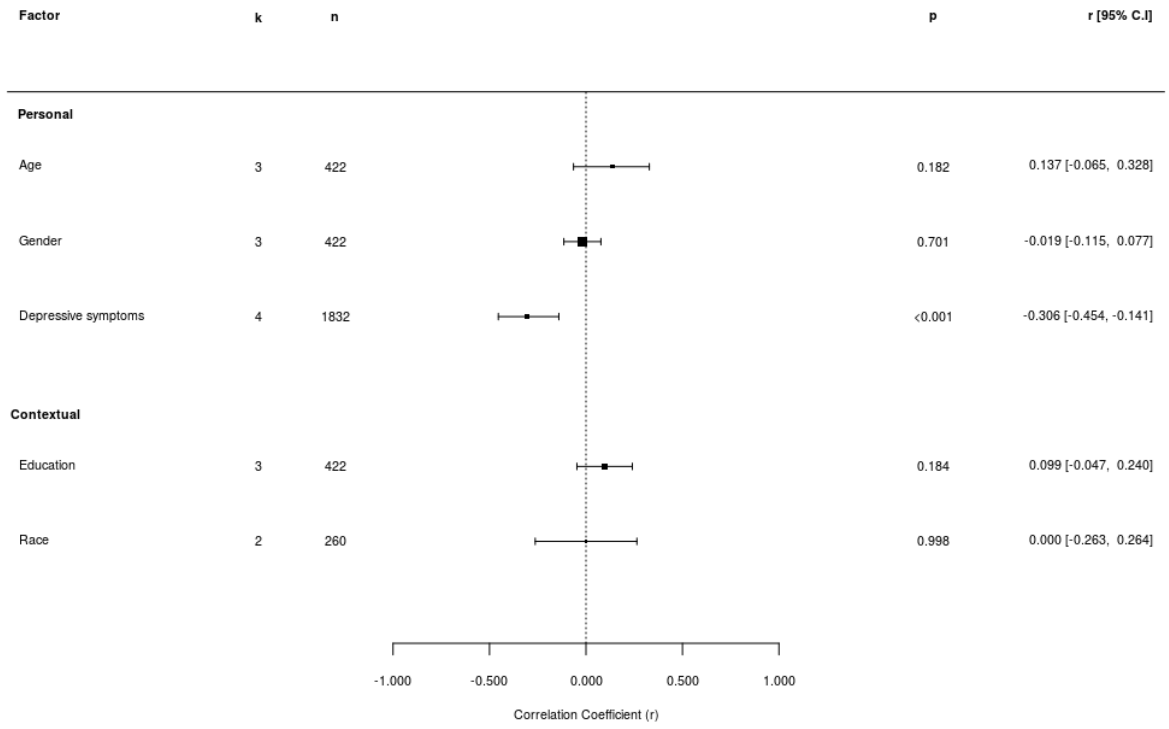


Table 1: Between-study heterogeneity for meta-analysis corresponding to each factor

Factor	k	n	r [95% CI]	r_p	Q	Q_p	I^2 [95% CI]
Personal							
Age	12	8275	0.023 [-0.079,0.125]	0.661	67.67	<0.001	83.74% [73.06%,90.19%]
Gender	6	6301	0.054 [-0.018,0.126]	0.143	7.35	0.196	31.99% [0.00%,72.50%]
ADL limitations	2	10809	-0.13 [-0.399,0.159]	0.378	4.87	0.027	79.47% [11.35%,95.25%]
Cognitive functioning	2	1407	-0.192 [-0.595,0.289]	0.439	12.87	<0.001	92.23% [73.43%,97.73%]
Depressive symptoms	11	5707	-0.369 [-0.459,-0.273]	<0.001	193.51	<0.001	94.83% [92.45%,96.46%]
Health promoting lifestyle	3	369	0.529 [0.451,0.6]	<0.001	0.00	0.998	0.00% [0.00%,0.00%]
Life satisfaction	7	7157	0.334 [0.313,0.354]	<0.001	7.06	0.315	15.06% [0.00%,58.81%]
Loneliness	2	2187	-0.447 [-0.692,-0.109]	0.011	21.19	<0.001	95.28% [86.01%,98.41%]
Morale	4	1190	0.291 [0.191,0.384]	<0.001	5.93	0.115	49.45% [0.00%,83.27%]
Optimism	4	2094	0.549 [0.354,0.698]	<0.001	88.84	<0.001	96.62% [93.86%,98.14%]
Physical functioning	2	1838	0.252 [0.144,0.354]	<0.001	2.94	0.087	65.96% [0.00%,92.28%]
Positive daily emotions	3	101	0.394 [0.209,0.552]	<0.001	0.05	0.976	0.00% [0.00%,0.00%]
Negative daily emotions	3	101	-0.182 [-0.37,0.02]	0.077	1.35	0.509	0.00% [0.00%,84.61%]
Psychological distress	5	1159	-0.463 [-0.582,-0.326]	<0.001	8.93	0.063	55.19% [0.00%,83.45%]
Psychological wellbeing	2	311	0.404 [0.306,0.494]	<0.001	0.93	0.334	0.00%
Purpose in life	2	245	0.637 [0.407,0.791]	<0.001	6.42	0.011	84.43% [36.2%,96.2%]
Quality of life	2	372	0.369 [0.277,0.454]	<0.001	0.300	0.584	0.00%
Self-efficacy	2	268	0.517 [0.423,0.6]	<0.001	0.300	0.586	0.00%
Self-rated general health	10	7903	0.293 [0.231,0.354]	<0.001	46.59	<0.001	80.68% [65.40%,89.21%]
Self-rated mental health	13	9726	0.365 [0.284,0.442]	<0.001	137.97	<0.001	91.30% [86.96%,94.20%]
Self-rated physical health	14	9928	0.197 [0.150,0.244]	<0.001	30.19	0.004	56.95% [21.86%,76.28%]
Self-transcendence	2	245	0.571 [0.402,0.702]	<0.001	3.08	0.079	67.57% [0.00%,92.67%]
Sense of coherence	2	245	0.516 [0.166,0.751]	0.006	10.12	0.001	90.12% [63.86%,97.3%]
Social engagement	2	2904	0.357 [-0.078,0.678]	0.105	152.62	<0.001	99.34% [98.81%,99.64%]
Spirituality	3	2198	0.269 [0.22,0.317]	<0.001	1.61	0.448	0.00% [0.00%,87.04%]
Successful aging	4	2766	0.252 [0.096,0.396]	0.002	76.37	<0.001	96.07% [92.65%,97.90%]
Risk of suicidal behavior	2	2034	-0.26 [-0.373,-0.139]	<0.001	8.15	0.004	87.73% [52.48%,96.83%]
Contextual							
Education	5	3411	0.09 [0.039,0.141]	<0.001	7.02	0.135	43.00% [0.00%,79.05%]
Income	3	1970	0.234 [0.075,0.382]	0.004	7.43	0.024	73.08% [9.56%,91.99%]
Marital status	3	6088	-0.033 [-0.329,0.269]	0.835	14.84	<0.001	86.53% [61.22%,95.32%]
Race	3	316	0.034 [-0.129,0.195]	0.682	3.46	0.178	42.15% [0%,82.49%]
Family network size	2	475	0.266 [0.145,0.379]	<0.001	1.92	0.166	47.78%
Friend network size	3	581	0.232 [0.154,0.308]	<0.001	0.78	0.678	0.00% [0.00%,73.24%]
Perceived stressfulness of the event	2	601	-0.578 [-0.75,-0.332]	<0.001	5.01	0.025	80.05% [14.21%,95.36%]
Social support	8	2158	0.273 [0.149,0.389]	<0.001	42.74	<0.001	83.62% [69.28%,91.27%]
Stigma	2	474	-0.484 [-0.778,-0.017]	0.043	28.29	<0.001	96.47% [90.35%,98.71%]
Support from friends	2	458	0.056 [-0.617,0.681]	0.888	60.34	<0.001	98.34% [96.29%,99.26%]
Support from family	2	458	0.066 [-0.522,0.611]	0.841	41.68	<0.001	97.60% [94.1%,99.02%]

Notes.CI = confidence interval; ADL = activities of daily living.

Online Supplementary Material

Supplementary Table 1. PRISMA checklist

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported in the section titled
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Background
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Background
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Protocol and Registration
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Inclusion and Exclusion Criteria
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Search strategy
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Search strategy
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Search strategy Procedure
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Procedure
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Statistical analysis Supplementary Table 4
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Procedure Supplementary Table 3
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Statistical analysis

Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Statistical analysis
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Statistical analysis
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Statistical analysis
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Results Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Results Measures of resilience Supplementary Table 5
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Supplementary Table 5
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Results Supplementary Table 7-8 Figures 2-4
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Results Figures 2-4
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Heterogeneity Table 1 Publication bias Supplementary material 9 & 10a-e
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Heterogeneity Supplementary Table 9
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Discussion
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Funding

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Supplementary Table 2. Resilience measures used in the included studies

Measurement tool	Type of resilience	Characteristics / conceptual foundations	Used in:
The Resilience Scale (Wagnild & Young, 1993)	Trait Resilience	Captures personality characteristics of resilience (Resnick & Inguito, 2011), 25 items reflecting the five characteristics of resilience including: • self-reliance or believing in oneself, • meaning, and the realization that life has purpose and meaning, • equanimity or acceptance of events that happen through life, • perseverance, which reflects persistence despite adversity, • existential aloneness or the realization that each person is unique and some experiences must be faced alone Items fit into two factors: Personal Competence and Acceptance of Self and Life. Scale from disagree (1) to agree (7). Interpretation of scores: • >145 indicate moderately high to high resilience • 126 – 145 moderately low to moderate resilience • <125 low resilience Measure of resilience most frequently used with older adults (Resnick & Inguito, 2011). Evidence supporting psychometric properties for older adults available in: Resnick & Inguito, 2011; Wagnild, 2003; Wagnild & Young, 1993.	19 independent studies: Coutto et al. 2011 Fraitag & Schmidt, 2016 King & Richardson, 2016 Lee et al. 2008 Manning et al. 2016 McClain et al. 2018 Moe et al. 2013 Nygren et al. 2005 Polson et al. 2018 Torma et al. 2013 Wagnild, 2003 (reporting 5 independent studies) Wagnild & Torma, 2013 Wagnild & Young, 1993 Wells, 2009 Wells, 2010
Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Captures personality aspects of resilience (Resnick & Inguito, 2011). Main scale includes 25 items, all of which carry a 5-point range of responses, as follows: not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all of the time (4). The scale is rated based on how the subject has felt over the past month. The total score ranges from 0–100, with higher scores reflecting greater resilience (Connor & Davidson, 2003). Three authorized versions: 25 item CD-RISC; 10 item CD-RISC-10; 2 item CD-RISC-2. Other versions available but unauthorized due to substantial modifications (Davidson, 2020). Psychometric properties established for various populations (Davidson, 2020).	17 independent studies: Jeste et al. 2013 Jeste et al. 2019 Kuwert et al. 2014 Lamond et al. 2008 Lim et al. 2015 Lu et al. 2017 Martin et al. 2015b McKibbin et al. 2016 Montross et al. 2006 Moore et al. 2015 Scelzo et al. 2013 Schure et al. 2013 Silverman et al. 2015 Smith, 2009 Smith, 2012 Vahia et al. 2011 You & Park, 2007
Dispositional Resilience Scale (Bartone et al., 1989)	Trait resilience	The theoretical background to the development of this scale is derived from the hardiness literature, and in a number of applications it is referred to as a measure of hardiness. As a personality style, it might assist in a resilient response from the individual level, however it is generally regarded as a fixed trait and does not fit well with the notion of resilience as a dynamic process. 3 dimensions, 45 items. Psychometric properties reported: Bartone et al., 1989; Bartone, 1991; Bartone, 1995; Bartone, 2007.	4 independent studies: Ong et al. 2006 (two independent studies) Rossi et al. 2007 Wallace et al. 2001
Ego Resiliency Scale (Block & Kremen, 1996)	Trait resilience	Ego-resilience conceptualized as an aspect of personality which in turn served as a "structure for managing emotion" (Block, 2002). Personality as an adaptive system for taking in and organizing information and maintaining non-disruptive levels of anxiety while responding to inner and outer demands. Block's construct refers to a "personality trait" (Prince-Embury, 2013). Fourteen items, scored 1-4 (does not apply at all – applies very strongly) (Block & Kremen, 1996). Scores from 0-56, with higher score representing higher resilience. Psychometric properties reported by Block & Kremen (1996).	2 independent studies: Baldwin et al. 2011 Ong et al. 2006

The Pearlin Mastery Scale (Pearlin & Schooler 1978)	Trait resilience	The Pearlin Mastery Scale (PM) measures an individual's level of mastery, which is a psychological resource that has been defined as "the extent to which one regards one's life-chances as being under one's own control in contrast to being fatalistically ruled" (Pearlin & Schooler, 1978, p.5). Mastery, as an aspect of psychological coping, used as an indicator of resilience. The 7-item scale comprises five negatively worded items and two positively worded items, presented with the following response options: (1) Strongly Disagree (2) Disagree (3) Agree (4) Strongly Agree. The negatively worded items require reverse coding prior to scoring, resulting in a score range of 7 to 28, with higher scores indicating greater levels of mastery.	1 study: Liddell & Ferreira, 2019
Brief Resilience Scale (Smith et al., 2008)	Resilience as coping process	Brief resilience scale was designed to determine whether it is possible to reliably assess resilience as a process of bouncing back from stress (Smith et al., 2008). It consists of 6 items, scored 1-5 (from 'strongly agree' to 'strongly disagree') but 3 positive, three negative statements implying reverse scoring for half of items. Psychometric properties reported by Smith et al. (2008).	2 independent studies: Bartley et al. 2019 Fullen et al. 2018
Hardy-Gill Resilience Scale (Hardy, Concato & Gill, 2004)	Resilience as coping process	Hardy-Gill Resilience Scale assesses resilience as a coping process in response to a specific life event (Resnick & Inguito, 2011). Tool developed based on the construct of resilience as described by Rowe et al. (1997). Six items, scores ranging from 0 (low) to 18 (high). Psychometric properties reported Hardy, Concato & Gill (2004).	2 independent studies: Hardy et al. 2004 Mehta et al. 2018
Resilience Appraisal Scale (Johnson, Gooding, Wood & Tarrier, 2010)	Resilience as coping process	Rooted in the Schematic Appraisals Model of Suicide (SAMS; Johnson, Gooding & Tarrier, 2008). Three types of positive self-appraisals considered as important in buffering individuals from suicidal thoughts in the face of stressful life events (Johnson et al., 2008). These are appraisals of the individual's ability to cope with emotions, solve problems, and gain social support. 12 items tool reflecting these areas. Responses rated on a 5 point scale from 'strongly disagree' to 'strongly agree'. Preliminary psychometric properties reported by Johnson et al. (2010).	2 independent studies: Carandang et al. 2019 Li et al. 2015

Supplementary Table 3. National Heart, Lung and Blood Institute (NIH) Quality Assessment Tool for Observational Cohort and Cross-sectional Studies (NIH, 2020)

Study: **Date:**

Criteria	Yes	No	Other (CD, NR, NA)*
1. Was the research question or objective in this paper clearly stated?			
2. Was the study population clearly specified and defined?			
3. Was the participation rate of eligible persons at least 50%?			
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?			
5. Was a sample size justification, power description, or variance and effect estimates provided?			
6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?			
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?			
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?			
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			
10. Was the exposure(s) assessed more than once over time?			
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?			
12. Were the outcome assessors blinded to the exposure status of participants?			
13. Was loss to follow-up after baseline 20% or less?			
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?			

CD=cannot determine; NA=not applicable; NR=not reported

Quality Rating (Good, Fair, or Poor)	
Rater #1 initials:	
Rater #2 initials:	
Additional Comments (If POOR, please state why):	

Guidance for Assessing the Quality of Observational Cohort and Cross-Sectional Studies

The guidance document below is organized by question number from the tool for quality assessment of observational cohort and cross-sectional studies.

Question 1. Research question

Did the authors describe their goal in conducting this research? Is it easy to understand what they were looking to find? This issue is important for any scientific paper of any type. Higher quality scientific research explicitly defines a research question.

Questions 2 and 3. Study population

Did the authors describe the group of people from which the study participants were selected or recruited, using demographics, location, and time period? If you were to conduct this study again, would you know who to recruit, from where, and from what time period? Is the cohort population free of the outcomes of interest at the time they were recruited?

An example would be men over 40 years old with type 2 diabetes who began seeking medical care at Phoenix Good Samaritan Hospital between January 1, 1990 and December 31, 1994. In this example, the population is clearly described as: (1) who (men over 40 years old with type 2 diabetes); (2) where (Phoenix Good Samaritan Hospital); and (3) when (between January 1, 1990 and December 31, 1994). Another example is women ages 34 to 59 years of age in 1980 who were in the nursing profession and had no known coronary disease, stroke, cancer, hypercholesterolemia, or diabetes, and were recruited from the 11 most populous States, with contact information obtained from State nursing boards.

In cohort studies, it is crucial that the population at baseline is free of the outcome of interest. For example, the nurses' population above would be an appropriate group in which to study incident coronary disease. This information is usually found either in descriptions of population recruitment, definitions of variables, or inclusion/exclusion criteria.

You may need to look at prior papers on methods in order to make the assessment for this question. Those papers are usually in the reference list.

If fewer than 50% of eligible persons participated in the study, then there is concern that the study population does not adequately represent the target population. This increases the risk of bias.

Question 4. Groups recruited from the same population and uniform eligibility criteria

Were the inclusion and exclusion criteria developed prior to recruitment or selection of the study population? Were the same underlying criteria used for all of the subjects involved? This issue is related to the description of the study population, above, and you may find the information for both of these questions in the same section of the paper.

Most cohort studies begin with the selection of the cohort; participants in this cohort are then measured or evaluated to determine their exposure status. However, some cohort studies may recruit or select exposed participants in a different time or place than unexposed participants, especially retrospective cohort studies–which is when data are obtained from the past (retrospectively), but the analysis examines exposures prior to outcomes. For example, one research question could be whether diabetic men with clinical depression are at higher risk for cardiovascular disease than those without clinical depression. So, diabetic men with depression might be selected from a mental health clinic, while diabetic men without depression might be selected from an internal medicine or endocrinology clinic. This study recruits groups from different clinic populations, so this example would get a "no."

However, the women nurses described in the question above were selected based on the same inclusion/exclusion criteria, so that example would get a "yes."

Question 5. Sample size justification

Did the authors present their reasons for selecting or recruiting the number of people included or analyzed? Do they note or discuss the statistical power of the study? This question is about whether or not the study had enough participants to detect an association if one truly existed.

A paragraph in the methods section of the article may explain the sample size needed to detect a hypothesized difference in outcomes. You may also find a discussion of power in the discussion section (such as the study had 85 percent power to detect a 20 percent increase in the rate of an outcome of interest, with a 2-sided alpha of 0.05). Sometimes estimates of variance and/or estimates of effect size are given, instead of sample size calculations. In any of these cases, the answer would be "yes."

However, observational cohort studies often do not report anything about power or sample sizes because the analyses are exploratory in nature. In this case, the answer would be "no." This is not a "fatal flaw." It just may indicate that attention was not paid to whether the study was sufficiently sized to answer a prespecified question–i.e., it may have been an exploratory, hypothesis-generating study.

Question 6. Exposure assessed prior to outcome measurement

This question is important because, in order to determine whether an exposure causes an outcome, the exposure must come before the outcome.

For some prospective cohort studies, the investigator enrolls the cohort and then determines the exposure status of various members of the cohort (large epidemiological studies like Framingham used this approach). However, for other cohort studies, the cohort is selected based on its exposure status, as in the example above of depressed diabetic men (the exposure being depression). Other examples include a cohort identified by its exposure to fluoridated drinking water and then compared to a cohort living in an area without fluoridated water, or a cohort of military personnel exposed to combat in the Gulf War compared to a cohort of military personnel not deployed in a combat zone.

With either of these types of cohort studies, the cohort is followed forward in time (i.e., prospectively) to assess the outcomes that occurred in the exposed members compared to nonexposed members of the cohort. Therefore, you begin the study in the present by looking at groups that were exposed (or not) to some biological or behavioral factor, intervention, etc., and then you follow them forward in time to examine outcomes. If a cohort study is conducted properly, the answer to this question should be "yes," since the exposure status of members of the cohort was determined at the beginning of the study before the outcomes occurred.

For retrospective cohort studies, the same principal applies. The difference is that, rather than identifying a cohort in the present and following them forward in time, the investigators go back in time (i.e., retrospectively) and select a cohort based on their exposure status in the past and then follow them forward to assess the outcomes that occurred in the exposed and nonexposed cohort members. Because in retrospective cohort studies the exposure and outcomes may have already occurred (it depends on how long they follow the cohort), it is important to make sure that the exposure preceded the outcome.

Sometimes cross-sectional studies are conducted (or cross-sectional analyses of cohort-study data), where the exposures and outcomes are measured during the same timeframe. As a result, cross-sectional analyses provide weaker evidence than regular cohort studies regarding a potential causal relationship between exposures and outcomes. For cross-sectional analyses, the answer to Question 6 should be "no."

Question 7. Sufficient timeframe to see an effect

Did the study allow enough time for a sufficient number of outcomes to occur or be observed, or enough time for an exposure to have a biological effect on an outcome? In the examples given above, if clinical depression has a biological effect on increasing risk for CVD, such an effect may take years. In the other example, if higher dietary sodium increases BP, a short timeframe may be sufficient to assess its association with BP, but a longer timeframe would be needed to examine its association with heart attacks.

The issue of timeframe is important to enable meaningful analysis of the relationships between exposures and outcomes to be conducted. This often requires at least several years, especially when looking at health outcomes, but it depends on the research question and outcomes being examined.

Cross-sectional analyses allow no time to see an effect, since the exposures and outcomes are assessed at the same time, so those would get a "no" response.

Question 8. Different levels of the exposure of interest

If the exposure can be defined as a range (examples: drug dosage, amount of physical activity, amount of sodium consumed), were multiple categories of that exposure assessed? (for example, for drugs: not on the medication, on a low dose, medium dose, high dose; for dietary sodium, higher than average U.S. consumption, lower than recommended consumption, between the two). Sometimes discrete categories of exposure are not used, but instead exposures are measured as continuous variables (for example, mg/day of dietary sodium or BP values).

In any case, studying different levels of exposure (where possible) enables investigators to assess trends or dose-response relationships between exposures and outcomes–e.g., the higher the exposure, the greater the rate of the health outcome. The presence of trends or dose-response relationships lends credibility to the hypothesis of causality between exposure and outcome.

For some exposures, however, this question may not be applicable (e.g., the exposure may be a dichotomous variable like living in a rural setting versus an urban setting, or vaccinated/not vaccinated with a one-time vaccine). If there are only two possible exposures (yes/no), then this question should be given an "NA," and it should not count negatively towards the quality rating.

Question 9. Exposure measures and assessment

Were the exposure measures defined in detail? Were the tools or methods used to measure exposure accurate and reliable–for example, have they been validated or are they objective? This issue is important as it influences confidence in the reported exposures. When exposures are measured with less accuracy or validity, it is harder to see an association between exposure and outcome even if one exists. Also as important is whether the exposures were assessed in the same manner within groups and between groups; if not, bias may result.

For example, retrospective self-report of dietary salt intake is not as valid and reliable as prospectively using a standardized dietary log plus testing participants' urine for sodium content. Another example is measurement of BP, where there may be quite a difference between usual care, where clinicians measure BP however it is done in their practice setting (which can vary considerably), and use of trained BP assessors using standardized equipment (e.g., the same BP device which has been tested and calibrated) and a standardized protocol (e.g., patient is seated for 5 minutes with feet flat on the floor, BP is taken twice in each arm, and all four measurements are averaged). In each of these cases, the former would get a "no" and the latter a "yes."

Here is a final example that illustrates the point about why it is important to assess exposures consistently across all groups: If people with higher BP (exposed cohort) are seen by their providers more frequently than those without elevated BP (nonexposed group), it also increases the chances of detecting and documenting changes in health outcomes, including CVD-related events. Therefore, it may lead to the conclusion that higher BP leads to more CVD events. This may be true, but it could also be due to the

fact that the subjects with higher BP were seen more often; thus, more CVD-related events were detected and documented simply because they had more encounters with the health care system. Thus, it could bias the results and lead to an erroneous conclusion.

Question 10. Repeated exposure assessment

Was the exposure for each person measured more than once during the course of the study period? Multiple measurements with the same result increase our confidence that the exposure status was correctly classified. Also, multiple measurements enable investigators to look at changes in exposure over time, for example, people who ate high dietary sodium throughout the follow-up period, compared to those who started out high then reduced their intake, compared to those who ate low sodium throughout. Once again, this may not be applicable in all cases. In many older studies, exposure was measured only at baseline. However, multiple exposure measurements do result in a stronger study design.

Question 11. Outcome measures

Were the outcomes defined in detail? Were the tools or methods for measuring outcomes accurate and reliable–for example, have they been validated or are they objective? This issue is important because it influences confidence in the validity of study results. Also important is whether the outcomes were assessed in the same manner within groups and between groups.

An example of an outcome measure that is objective, accurate, and reliable is death–the outcome measured with more accuracy than any other. But even with a measure as objective as death, there can be differences in the accuracy and reliability of how death was assessed by the investigators. Did they base it on an autopsy report, death certificate, death registry, or report from a family member? Another example is a study of whether dietary fat intake is related to blood cholesterol level (cholesterol level being the outcome), and the cholesterol level is measured from fasting blood samples that are all sent to the same laboratory. These examples would get a "yes." An example of a "no" would be self-report by subjects that they had a heart attack, or self-report of how much they weigh (if body weight is the outcome of interest).

Similar to the example in Question 9, results may be biased if one group (e.g., people with high BP) is seen more frequently than another group (people with normal BP) because more frequent encounters with the health care system increases the chances of outcomes being detected and documented.

Question 12. Blinding of outcome assessors

Blinding means that outcome assessors did not know whether the participant was exposed or unexposed. It is also sometimes called "masking." The objective is to look for evidence in the article that the person(s) assessing the outcome(s) for the study (for example, examining medical records to determine the outcomes that occurred in the exposed and comparison groups) is masked to the exposure status of the participant. Sometimes the person measuring the exposure is the same person conducting the outcome assessment. In this case, the outcome assessor would most likely not be blinded to exposure status because they also took measurements of exposures. If so, make a note of that in the comments section.

As you assess this criterion, think about whether it is likely that the person(s) doing the outcome assessment would know (or be able to figure out) the exposure status of the study participants. If the answer is no, then blinding is adequate. An example of adequate blinding of the outcome assessors is to create a separate committee, whose members were not involved in the care of the patient and had no information about the study participants' exposure status. The committee would then be provided with copies of participants' medical records, which had been stripped of any potential exposure information or personally identifiable information. The committee would then review the records for prespecified outcomes according to the study protocol. If blinding was not possible, which is sometimes the case, mark "NA" and explain the potential for bias.

Question 13. Follow-up rate

Higher overall follow-up rates are always better than lower follow-up rates, even though higher rates are expected in shorter studies, whereas lower overall follow-up rates are often seen in studies of longer duration. Usually, an acceptable overall follow-up rate is considered 80 percent or more of participants whose exposures were measured at baseline. However, this is just a general guideline. For example, a 6-month cohort study examining the relationship between dietary sodium intake and BP level may have over 90 percent follow-up, but a 20-year cohort study examining effects of sodium intake on stroke may have only a 65 percent follow-up rate.

Question 14. Statistical analyses

Were key potential confounding variables measured and adjusted for, such as by statistical adjustment for baseline differences? Logistic regression or other regression methods are often used to account for the influence of variables not of interest.

This is a key issue in cohort studies, because statistical analyses need to control for potential confounders, in contrast to an RCT, where the randomization process controls for potential confounders. All key factors that may be associated both with the exposure of interest and the outcome–that are not of interest to the research question–should be controlled for in the analyses.

For example, in a study of the relationship between cardiorespiratory fitness and CVD events (heart attacks and strokes), the study should control for age, BP, blood cholesterol, and body weight, because all of these factors are associated both with low fitness and with CVD events. Well-done cohort studies control for multiple potential confounders.

Some general guidance for determining the overall quality rating of observational cohort and cross-sectional studies

The questions on the form are designed to help you focus on the key concepts for evaluating the internal validity of a study. They are not intended to create a list that you simply tally up to arrive at a summary judgment of quality.

Internal validity for cohort studies is the extent to which the results reported in the study can truly be attributed to the exposure being evaluated and not to flaws in the design or conduct of the study–in other words, the ability of the study to draw associative conclusions about the effects of the exposures being studied on outcomes. Any such flaws can increase the risk of bias.

Critical appraisal involves considering the risk of potential for selection bias, information bias, measurement bias, or confounding (the mixture of exposures that one cannot tease out from each other). Examples of confounding include co-interventions, differences at baseline in patient characteristics, and other issues throughout the questions above. High risk of bias translates to a rating of poor quality. Low risk of bias translates to a rating of good quality. (Thus, the greater the risk of bias, the lower the quality rating of the study.)

In addition, the more attention in the study design to issues that can help determine whether there is a causal relationship between the exposure and outcome, the higher quality the study. These include exposures occurring prior to outcomes, evaluation of a dose-response gradient, accuracy of measurement of both exposure and outcome, sufficient timeframe to see an effect, and appropriate control for confounding–all concepts reflected in the tool.

Generally, when you evaluate a study, you will not see a "fatal flaw," but you will find some risk of bias. By focusing on the concepts underlying the questions in the quality assessment tool, you should ask yourself about the potential for bias in the study you are critically appraising. For any box where you check "no" you should ask, "What is the potential risk of bias resulting from this flaw in study design or execution?" That is, does this factor cause you to doubt the results that are reported in the study or doubt the ability of the study to accurately assess an association between exposure and outcome?

The best approach is to think about the questions in the tool and how each one tells you something about the potential for bias in a study. The more you familiarize yourself with the key concepts, the more comfortable you will be with critical appraisal. Examples of studies rated good, fair, and poor are useful, but each study must be assessed on its own based on the details that are reported and consideration of the concepts for minimizing bias.

Supplementary Table 4. Data Extraction Form, adapted from Joanna Brigg's Institute (JBI) Reviewer's Manual (Aromataris & Munn, 2020)

Study details		
Author(s):		
Year:		
Journal:		
Title:		
Study method/characteristics		
Study design –the type of study e.g., cohort study/cross-sectional study		
Setting – e.g., hospital / community		
Sample size		
Participants - age, sex, country/location, diagnosis other relevant info		
Recruitment procedures		
Follow-up or study duration		
Exposure(s) of interest (Independent variable) – type, frequency, duration		
Variables of interest & measurement	Outcome variable	Secondary variable(s) (independent)
Outcomes – the primary outcome measured and where relevant includes associated secondary outcomes.		
Outcome measurements – describe the scales or tools used to measure the outcomes.		
Data analysis methods including statistical technique, adjustment for confounding factors, etc.		
Study results / appropriate measures		
E.g., Correlation coefficient r Regression coefficient standardized β Odds ratio P value & 95% Confidence Intervals t statistic F statistic		
Reviewer's comments		

Supplementary Table 5. Included studies

Study	Country & design	n	Setting	Mean age	% Female	Resilience Measure	Resilience conceptualization	Factors included in meta-analysis	Quality rating
Baldwin et al. (2011)	United States Cross-sectional	52	Community	74	65	Ego Resiliency Scale (Block & Kremen, 1996)	Trait resilience	Psychological distress Optimism	Poor
Bartley et al. (2019)	United States Cross-sectional	60	Community	68.1	56.7	Brief Resilience Scale (Smith et al., 2008)	Resilience as coping process	Age Gender Race Education Marital status Employment Income	Good
Carandang et al. (2019)	Philippines Cross-sectional	1021	Community	M: 67.3 F: 67.9	68.5	Resilience Appraisal Scale (Johnson et al., 2010)	Resilience as coping process	Depressive symptoms	Good
Freitag & Schmidt (2016)	Germany Cross-sectional	210	Community	75.3	62.4	The Resilience Scale (Wagnild & Young, 1993)	Trait Resilience	Depressive symptoms QoL Social support Self-efficacy	Fair
Fullen et al. (2018)	United States Cross-sectional	200	Independent living senior housing communities	73.7	84	Brief Resilience Scale (Smith et al., 2008)	Resilience as coping process	Age Gender Race Education Successful aging Life satisfaction Self-rated physical health Psychological/mental wellbeing	Fair
Hardy et al. (2004)	United States Cross-sectional	546	Community	73.72	64	Hardy-Gill Resilience Scale (Hardy et al., 2004)	Resilience as coping process	Depressive symptoms Perceived stressfulness of event	Good
Jeste et al. (2013)	United States Cross-sectional	1006	Community	77.3	NR	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Successful aging	Good
Jeste et al. (2019)	United States Cross-sectional	104	Continuing care senior housing community	83.6	67	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Self-rated physical health	Poor
King & Richardson (2016)	United States Cross-sectional	316	Community	57.78	0	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Marital status Income Social support Support from family Support from friends Stigma	Fair
Kuwert et al. (2014)	United States Cross-sectional	2025	Community	71	3.8	Connor Davidson Resilience Scale-10 (Connor & Davidson, 2008)	Trait resilience	Loneliness	Good

Lamond et al. (2008)	United States Cross-sectional	1395	Community	72.7	100	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Age Education Successful aging Self-rated physical health (SF-36) Self-rated mental health (SF-6) Social engagement Optimism Cognitive functioning	Fair
Lee et al. (2008)	United States Cross-sectional	200	Community	72.5	100	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Age Optimism Spirituality	Fair
Li et al. (2015)	Singapore Cross-sectional	162	Community	72.2	75.9	Resilience Appraisal Scale (Johnson et al., 2010)	Resilience as coping process	Age Gender Education Depressive symptoms QoL Social support Loneliness	Fair
Liddell & Ferreira (2019)	United States Cross-sectional	5713	Community	73.3	63.7	The Pearlin Mastery Scale (Pearlin & Schooler, 1978)	Tait resilience	Age Gender Marital status Self-rated general health Self-rated physical health Self-rated mental health Depression Life satisfaction	Fair
Lim et al. (2015)	China Cross-sectional	385	Community	72.1	58.1	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Depressive symptoms	Good
Lu et al. (2017)	China Cross-sectional	474	Community	69.3	53	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Depressive symptoms Self-rated health (SF-12) Self-rated physical health (SF-12) Self-rated mental health (SF-12) Optimism	Fair
Manning et al. (2016)	United States Longitudinal	10753	Community	68.6	59	Simplified Resilience Score (Zeng & Shen, 2010) based on Wagnild & Young (1993) Resilience Scale	Trait resilience	ADL limitations	Poor
Martin et al. (2015b)	United States Cross-sectional	N=1006 YO:365 OO:641	Community	YO:63.3 OO:85.3	YO:49 OO:48.3	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Successful aging	Fair
McClain et al. (2018)	United States Cross-sectional	58	Community	74.5	74.1	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated physical health (SF-36) Self-efficacy Social support	Fair

McKibbin et al. (2016)	United States Cross-sectional	198	Community-rural	73.7	52.5	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Self-rated physical health (SF-12) Self-rated mental health (SF-12) Family network size Friend network size	Fair
Mehta et al. (2008)	United States Cross-sectional	105	Community	79.3	80	Hardy-Gill Resilience Scale (Hardy et al 2004)	Resilience as coping process	Depressive symptoms	Fair
Moe et al. (2013)	Norway Cross-sectional	120	Community – home or sheltered housing	87.5	65.8	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated physical health (SF-36) Self-rated mental health (SF-36) Self-transcendence Purpose in life Sense of coherence	Fair
Montross et al. (2006)	United States Cross-sectional	205	Continuing care retirement communities	80.4	60	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Successful aging	Fair
Moore et al. (2015)	United States Cross-sectional	1006	Community	77	NR	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Successful aging Self-rated physical health (SF-36) Self-rated mental health (SF-36) Social support Psychological distress	Fair
Nygren et al. (2005)	Sweden Cross-sectional	125	Community	NR (85+)	69	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated physical health (SF-36) Self-rated mental health (SF-36) Self-transcendence Purpose in life Sense of coherence	Fair
Ong et al. (2006)	United States Cross-sectional	27	Community	72.1	48	Ego Resiliency Scale (Block & Kremen, 1996)	Trait resilience	Psychological distress Positive daily emotions Negative daily emotions	Fair
	United States Cross-sectional	40	Community	75.5	50	Dispositional Resilience Scale (Bartone et al., 1989)	Trait resilience	Psychological distress Positive daily emotions Negative daily emotions	Fair
	United States Cross-sectional	34	Community	71.9	100	Dispositional Resilience Scale (Bartone et al., 1989)	Trait resilience	Psychological distress Positive daily emotions Negative daily emotions	Fair
de Paula Couto et al. (2011)	Brazil Cross-sectional	111	Community	68.6	83	The Resilience Scale (Wagnild & Young, 1993)	Trait Resilience	Age Gender Psychological/mental wellbeing	Fair
Polson et al. (2018)	United States Cross-sectional	64	Community	72.7	67	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Age Gender Race Self-rated mental health Social support Cognitive functioning Spirituality	Fair

Rossi et al. (2007)	United States Cross-sectional	55	Community	71.5	100	Dispositional Resilience Scale (Bartone et al., 1989)	Trait resilience	Age Perceived stressfulness of event Life satisfaction	Fair
Scelzo et al. (2018)	Italy Cross-sectional	N=80 YO: 51 OO: 29	Community	NR YO:51-75 OO:90-101	NR	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Age Self-rated physical health (SF-12) Self-rated mental health (SF-12)	Fair
Schure et al. (2013)	United States Cross-sectional	185	Community	68.7	69.2	10-item abbreviated version of Connor-Davidson Resilience Scale (CD-RISC, Campbell-Sills & Stein, 2007; Connor & Davidson, 2003	Trait resilience	Self-rated physical health (SF-8) Self-rated mental health (SF-8)	Fair
Silverman et al. (2015)	United States Longitudinal	1594	Community	56	64	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Education Income Depressive symptoms Physical functioning Social engagement	Good
Smith (2009)	United States Cross-sectional	158	Community	NR (65+)	76.6	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Self-rated health	Good
Smith (2012)	United States Cross-sectional	158	Community	75.2	76	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Depressive symptoms Stigma	Poor
Torma et al. (2013)	United States Cross-sectional	224	Community	62.1	94	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Age Depressive symptoms Physical function Social support	Good
Vahia et al. (2011)	United States Cross-sectional	1942	Community	73	100	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Spirituality	Good
Wagnild (2003) Low income	United States Cross-sectional	43	Community	73.4	83.8	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Life satisfaction Self-rated health Morale	Poor
High income	United States Cross-sectional	176	Community	69.5	49.4	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Life satisfaction Self-rated health Morale	Poor
Low income	United States Cross-sectional	161	Community	74.9	85.1	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Life satisfaction Self-rated health Morale	Poor
High income	United States Cross-sectional	232	Community	69.1	44	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated health Health promoting lifestyle	Poor
Low income	United States Cross-sectional	112	Community	74.9	83.9	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated health Health promoting lifestyle	Poor
Wagnild & Torma (2013)	United States Cross-sectional	25	Community	75.7	100	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated health Health promoting lifestyle	Poor

Wagnild & Young (1993)	United States Cross-sectional	810	Community	71.1	62.3	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Depressive symptoms Life satisfaction Self-rated health Morale	Good
Wallace et al. (2001)	United States Cross-sectional	range: 367-421	Community	75	77	Dispositional Resilience Scale (Bartone et al., 1989)	Trait Resilience	Support from family Support from friends	Poor
Wells (2009)	United States Cross-sectional	106	Community	75	54	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated physical health (SF-12) Self-rated mental health (SF-12) Social support Friend network size	Fair
Wells (2010)	United States Cross-sectional	277	Community	75	53.4	The Resilience Scale (Wagnild & Young, 1993)	Trait resilience	Self-rated physical health (SF-12) Self-rated mental health (SF-12) Family network size Friend network size	Fair
You & Park (2017)	South Korea Cross-sectional	2034	Community	74.5	59	Connor Davidson Resilience Scale (Connor & Davidson, 2008)	Trait resilience	Risk of suicidal behavior	Good

Quality ratings
Good (12): Bartley et al. (2019); Carandang et al. (2019); Hardy et al. (2004); Jeste et al. (2013); Kuwert et al. (2014); Lim et al. (2015); Silverman et al. (2015); Smith (2009); Torma et al. (2013); Vahia et al. (2014); Wagnild & Young (1993); You & Park (2017)
Fair (24): Couto et al. (2011); Freitag & Schmidt (2016); Fullen et al. (2018); King & Richardson (2016); Lamond et al. (2008); Lee et al. (2008); Li et al (2015); Liddell & Fereira (2019); Lu et al. (2017); Martin et al. (2015b); McClain et al. (2018); McKibbin et al. (2016); Mehta et al. (2008); Moe et al. (2013); Montross et al. (2006); Moore et al. (2015); Nygren et al. (2005); Ong et al. (2006); Polson et al. (2018); Rossi et al. (2007); Scelzo et al. (2018); Schure et al. (2013); Wells (2009); Wells (2010)
Poor (7): Baldwing et al. (2011); Jeste et al. (2019); Manning et al. (2016); Smith (2012); Wagnild (2003); Wagnild & Torma (2013); Wallace et al. (2001)

Design: longitudinal 2; cross-sectional 41

Countries

USA: 33	Brazil: 1	Italy: 1	Philippines: 1	South Korea: 1
China: 2	Germany: 1	Norway: 1	Singapore: 1	Sweden: 1

Setting
Community: 39
Independent living senior housing communities: 3
Community – home or sheltered housing: 1

Supplementary Table 6. Articles excluded at the full-text screening stage

Primary reason for exclusion	Article
Mean age < 55 (n = 17)	Bernstein et al. (2017); Beutel et al. (2009); Brennan et al. (2017); Campbell-Sills et al. (2009); Driver et al. (2016); Eshel et al. (2018); Guest et al. (2015); Holden et al. (2013); Kilic et al. (2013); Marciano et al. (2019); Morote et al. (2017); Pekenham et al. (2018); Reyes et al. (2019); Sharpley et al. (2014); Spies & Seedat, (2014); Topel et al. (2019); Tugade et al. (2004)
No age data reported (n=1)	Wisco et al. (2014)
Non-standardized measure of resilience (n = 10)	Emlet et al. (2017); Hardy et al. (2002); Liebenberg & Moore (2018); Netuveli et al. (2008); Sawyer & Allman (2010); Shen & Zeng (2011); Smith & Hollinger-Smith (2015); Talsma (1996); Yang & Wen (2015); Zeng & Shen (2010)
Measure of physical resilience (n = 1)	Klinedinst & Resnick (2014)
No resilience measure (n = 5)	Cunha et al. (2017); Elby et al. (1996); Heisel et al. (2020); Pietrzak et al. (2014); Roos & Havens (1991);
Intervention study (n = 1)	Sun & Buys (2014)
Setting (n = 1)	Holmes et al. (2019)
Language (n = 3)	Min et al. (2017); Lei et al. (2018); Serrano-Parra et al. (2012)
Dissertation, findings in peer reviewed paper (included) (n = 1)	Fullen (2016)
Unable to source (despite, where possible, contacting authors) (n = 6)	Bane (1998); Boseman (2001); Johnson (2002); Lee et al. (2018); Wallace (1999)
Data not suitable for computing the desired effect size (n = 13)	Clark et al. (2019); Fullen & Granello (2018); Martins et al. (2011); Gooding et al. (2012); Lamet et al. (2008); Lau et al. (2010); Lau et al. (2018); Mertens et al. (2012); Phillips et al. (2016); Siu et al. (2018); Stewart et al. (2019); Tomás et al. (2012); Vahia et al. (2010)

Supplementary Table 7. Personal factors associated with resilience identified across studies meeting inclusion criteria

	Factor	Reported in
1	ADL limitations*	Manning et al. (2016); Polson et al. (2018)
2	Age*	Bartley et al. (2019); Fullen et al. (2018); Lamond et al. (2008); Lee et al. (2008); Li et al. (2015); Liddell & Ferreir (2019); [1]*McKibbin et al. (2016)*; de Paula Couto et al. (2011); Polson et al (2018); Rossi et al. (2007); Scelzo et al. (2018) (YO); Scelzo et al. (2018) (OO); Torma et al. (2013); [2,3]*Zeng & Shen, (2010)*
3	Cognitive functioning*	Lamond et al. (2008); Polson et al. (2018)
4	Depressive symptoms*	Carandang et al. (2019); Freitag & Schmidt (2016); Hardy et al. (2004); Li et al. (2015); Lim et al. (2015); Lu et al. (2017); Mehta et al. (2008); [2]*Schure et al. (2013)*; Silverman et al. (2015); Smith (2012); Torma et al. (2013); [2]*Vahia et al. (2010)*; Wagnild & Young (1993)
5	Gender*	Bartley et al. (2019); Fullen et al. (2018); Li et al. (2015); Liddell & Ferreira (2019); [1]*McKibbin et al. (2016)*; de Paula Couto et al. (2011); Polson et al. (2018)
6	Health promoting lifestyle*	Wagnild (2003) (2 independent samples); Wagnild & Torma (2013)
7	Life satisfaction*	Fullen et al. (2018); Rossi et al. (2007); Wagnild (2003) (low income); Wagnild (2003) (high income); Wagnild (2003) (low income); Wagnild & Young (1993)
8	Loneliness*	Kuwert et al. (2014); Li et al. (2015)
9	Morale*	Wagnild (2003) (3 independent samples); Wagnild & Young (1993)
10	Optimism*	Baldwin et al. (2011); Lamond et al. (2008); Lee et al. (2008); Lu et al. (2017)
11	Physical functioning*	[2]*Mertens et al. (2012)*; Silverman et al. (2015); Torma et al. (2011)
12	Positive daily emotions*	Ong et al. (2006) (3 independent samples)
13	Negative daily emotions*	Ong et al. (2006) (3 independent samples)
14	Psychological distress*	Baldwin et al. (2011); Moore et al. (2015); Ong et al. (2006) (3 independent samples)
15	Psychological wellbeing*	Fullen et al. (2018); de Paula Couto et al. (2011)
16	Purpose in life*	Moe et al. (2013); Nygren et al. (2005)
17	Quality of life*	Freitag & Schmidt (2016); Li et al. (2015)
18	Self-efficacy*	Freitag & Schmidt (2016); McClain et al. (2018)
19	Self-rated general health*	Liddell & Ferreira (2019); Lu et al. (2017); Smith (2009); Wagnild (2003) (low income); Wagnild (2003) (high income); Wagnild (2003) (low income); Wagnild (2003) (high income); Wagnild (2003) (low income); Wagnild & Torma (2013); Wagnild & Young (1993)
20	Self-rated mental health*	Lamond et al. (2008); Liddell & Ferreira (2019); Lu et al. (2017); McKibbin et al. (2016); Moe et al. (2013); Moore et al. (2015); Nygren et al. (2005); Polson et al. (2018); Scelzo et al. (2018) (YO); Scelzo et al. (2018) (OO); Schure et al. (2013); Wells (2009); Wells (2010)
21	Self-rated physical health*	Fullen et al. (2018); [1]*Jeste et al. (2019)*; Lamond et al. (2008); Liddell & Ferreira (2019); Lu et al. (2017); McClain et al. (2018); McKibbin et al. (2016); Moe et al. (2013); Moore et al. (2015); Nygren et al. (2005); Scelzo et al. (2018) (YO); Scelzo et al. (2018) (OO); Schure et al. (2013); Wells (2009); Wells (2010)
22	Self-transcendence*	Moe et al. (2013); Nygren et al. (2005)
23	Sense of coherence*	Moe et al. (2013); Nygren et al. (2005)
24	Social engagement*	Lamond et al. (2008); [1]*Phillips et al. (2016);* Silverman et al. (2015)
25	Spirituality*	Lee et al. (2008); Polson et al. (2018); Vahia et al. (2011)
26	Successful aging*	Fullen et al. (2018); Jeste et al. (2013); Lamond et al. (2008*)*; [4]*Martin et al. (2015b) (YO);* [4]*Martin et al. (2015b) (OO)*; Montross et al. (2006); [4]*Moore et al. (2015)*; [2]*Stewart et al. (2019)*
27	Suicidal behavior risk*	You & Park (2017) (men); You & Park (2017) (women)
28	Willingness to seek help for depressive symptoms	[4]*Smith (2009)*; [4]*Smith (2012)*
29	ADL Independent	Hardy et al. (2004)
30	Anxiety	Freitag & Schmidt (2016)
31	Childhood physical abuse	Phillips et al. (2016)
32	Childhood social adversity	Phillips et al. (2016)
33	Childhood economic adversity	Phillips et al. (2016)
34	Comorbidity	Torma et al. (2013)
35	Chronic pain	Schure et al. (2013)
36	Current mood	Smith (2009)
37	Frailty	Freitag & Schmidt (2016)
38	Happiness	Fullen et al. (2018)
39	Hope	Polson et al. (2018)
40	Internal health locus of control	King & Richardson (2016)
41	IADL limitations	Manning et al. (2016)
42	Internalized homophobia	King & Richardson (2016)
43	Pain duration	Bartley et al. (2019)
44	Physical activity	Torma et al. (2011)

45	Self-esteem	Lee et al. (2008)
46	Self-perceived oral health	Martins et al. (2011)
47	Strength	Lu et al. (2017)
48	Tenacity	Lu et al. (2017)

*data available for meta-analysis
Italics: data excluded from meta-analysis [reasons for exclusion: [1]data not suitable for computing the required effect size; [2]categorical variable; [3]non-standardised measurement of resilience; [4]non-independent samples]
YO – young-old (as defined by authors); OO – old-old (as defined by authors)

Supplementary Table 8. Contextual factors associated with resilience identified across studies meeting inclusion criteria

	Factor	Reported in
1	Education*	Bartley et al. (2019); Fullen et al. (2018); Lamond et al. (2008); Li et al. (2015); [1]*McKibbin et al. (2016)*; Silverman et al. (2015); [2,3]*Zeng & Shen. (2010)*
2	Income*	Bartley et al. (2019); King & Richardson (2016); [1]*Philips et al. (2016)*; Silverman et al. (2015)
3	Marital status*	Bartley et al. (2019); King & Richardson (2016); Liddell & Ferreira (2019); [1]*McKibbin et al. (2016)*; [2,3]*Zeng & Shen (2010)*
4	Race*	Bartley et al. (2019); Fullen et al. (2018); Polson et al. (2018)
5	Family network size*	McKibbin et al. (2016); Wells (2010)
6	Friend network size*	McKibbin et al. (2016); Wells (2009); Wells (2010)
7	Perceived stressfulness of the event*	Hardy et al. (2004); Rossi et al. (2007)
8	Social support*	Freitag & Schmidt (2016); King & Richardson (2016); Li et al. (2015); McClain et al. (2018); Moore et al. (2015); Polson et al. (2018); Torma et al. (2013); Wells (2009)
90	Stigma*	King & Richardson (2016); Smith (2012)
10	Support from friends*	King & Richardson (2016); [2]*Philips et al. (2016)*; Wallace et al. (2011)
11	Support from family*	King & Richardson (2016); [2]*Philips et al. (2016)*; Wallace et al. (2011)
12	Living with others	[2]*Hardy et al. (2004)*; [1]*Liddell & Ferreira (2019)*; Li et al. (2015)
13	Cultural interdependency	Lee et al. (2008)
14	Discrimination	King & Richardson (2016)
15	Emotional support	Liddell & Ferreira (2019)
16	Employment	Bartley et al. (2019); [1]*McKibbin et al. (2016)*
17	Family functioning	Lu et al. (2017)
18	Length of marriage	Rossi et al. (2007)
19	Medical insurance	Fullen et al. (2018)
20	Perceived income adequacy	Li et al. (2015)
21	Race related stress	Baldwin et al. (2011)
22	Stressful events (number and intensity)	de Paula Couto et al. (2011)
23	Traumatic life events	Freitag & Schmidt (2016)

*data available for meta-analysis
Italics: data excluded from meta-analysis [reasons for exclusion: [1]data not suitable for computing the required effect size; [2]categorical variable; [3]non-standardised measurement of resilience]

Supplementary Table 9. Leave-one-out sensitivity analysis

Study omitted	r [95% CI]	r_p	I^2
Depressive symptoms			
Carandang et al. (2019)	-0.393 [-0.478,-0.301]	<0.001	91.40%
Freitag & Schmidt (2016)	-0.36 [-0.456,-0.254]	<0.001	95.30%
Hardy et al. (2004)	-0.375 [-0.473,-0.269]	<0.001	95.20%
Li et al. (2015)	-0.355 [-0.45,-0.253]	<0.001	95.30%
Lim et al. (2015)	-0.384 [-0.477,-0.284]	<0.001	95.00%
Lu et al. (2017)	-0.36 [-0.457,-0.254]	<0.001	95.30%
Mehta et al. (2008)	-0.378 [-0.472,-0.275]	<0.001	95.30%
Silverman et al. (2015)	-0.347 [-0.437,-0.25]	<0.001	90.60%
Smith (2012)	-0.39 [-0.476,-0.295]	<0.001	95.00%
Torma et al. (2013)	-0.351 [-0.444,-0.251]	<0.001	95.10%
Wagnild & Young (1993)	-0.369 [-0.468,-0.261]	<0.001	95.30%
Pooled estimate	**-0.369 [-0.459,-0.273]**	**<0.001**	**94.80%**
Successful aging			
Fullen et al. (2018)	0.273 [0.069,0.455]	0.009	97.3%
Jeste et al. (2013)	0.309 [0.154,0.449]	<0.001	86.9%
Lamond et al. (2008)	0.170 [0.062,0.275]	0.002	64.1%
Montross et al. (2006)	0.243 [0.031,0.434]	0.025	97.4%
Pooled estimate	**0.252 [0.096,0.396]**	**0.002**	**96.1%**
Life satisfaction			
Fullen et al. (2018)	0.333 [0.312,0.354]	<0.001	28.00%
Rossi et al. (2007)	0.333 [0.312,0.353]	<0.001	21.80%
Wagnild (2003) (low income)	0.332 [0.311,0.352]	<0.001	0.00%
Wagnild (2003) (high income)	0.332 [0.311,0.353]	<0.001	23.80%
Wagnild (2003) (low income)	0.333 [0.312,0.353]	<0.001	26.30%
Wagnild & Young (1993)	0.35 [0.31,0.39]	<0.001	13.80%
Liddell & Ferreira (2019)	0.356 [0.295,0.414]	<0.001	28.40%
Pooled estimate	**0.334 [0.313,0.354]**	**<0.001**	**15.10%**
Self-rated physical health			
Fullen et al. (2018)	0.186 [0.14,0.232]	<0.001	51.00%
Lamond et al. (2008)	0.209 [0.161,0.256]	<0.001	50.90%
Liddell & Ferreira (2019)	0.203 [0.149,0.256]	<0.001	57.60%
Lu et al. (2017)	0.181 [0.139,0.222]	<0.001	38.70%
McClain et al. (2018)	0.197 [0.148,0.245]	<0.001	60.20%
McKibbin et al. (2016)	0.2 [0.149,0.25]	<0.001	60.20%
Moe et al. (2013)	0.195 [0.145,0.243]	<0.001	59.30%
Moore et al. (2015)	0.195 [0.141,0.247]	<0.001	56.70%
Nygren et al. (2005)	0.203 [0.154,0.251]	<0.001	58.70%
Scelzo et al. (2018) (YO)	0.197 [0.148,0.245]	<0.001	60.10%
Scelzo et al. (2018) (OO)	0.196 [0.148,0.244]	<0.001	60.10%
Schure et al. (2013)	0.206 [0.159,0.253]	<0.001	55.90%
Wells (2009)	0.195 [0.145,0.244]	<0.001	59.60%
Wells (2010)	0.195 [0.143,0.245]	<0.001	59.00%
Pooled estimate	**0.197 [0.15,0.244]**	**<0.001**	**56.90%**

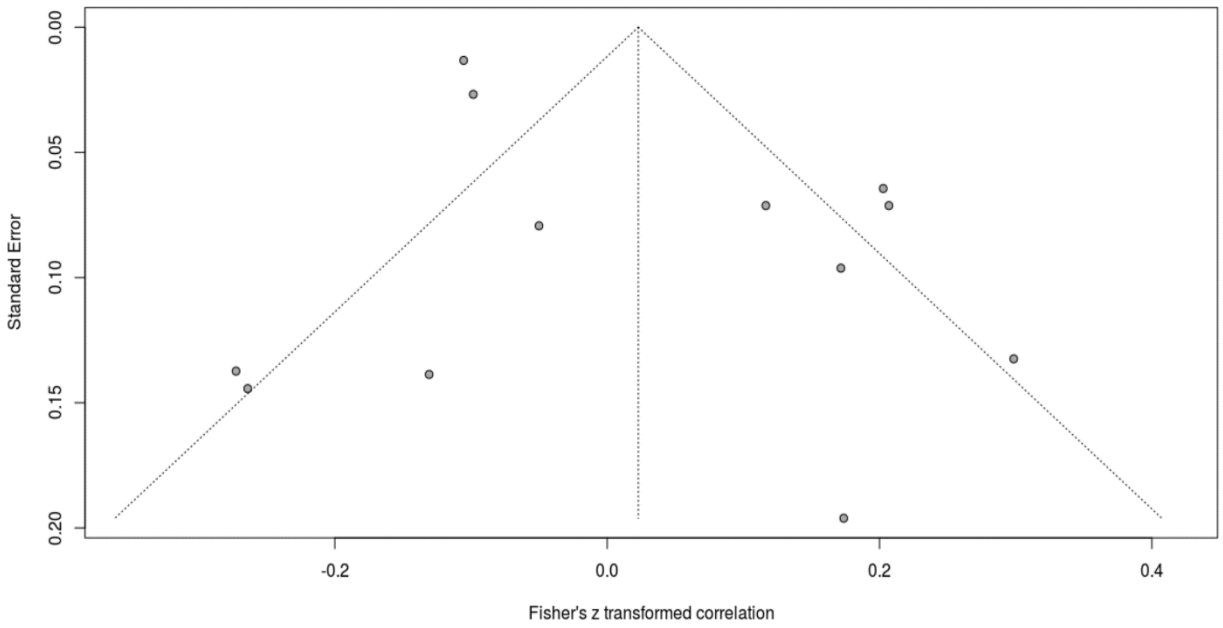
Self-rated mental health			
Lamond et al. (2008)	0.35 [0.264,0.431]	<0.001	85.00%
Liddell & Ferreira (2019)	0.377 [0.29,0.457]	<0.001	81.00%
Lu et al. (2017)	0.358 [0.268,0.442]	<0.001	91.60%
McKibbin et al. (2016)	0.354 [0.267,0.436]	<0.001	91.60%
Moe et al. (2013)	0.363 [0.274,0.446]	<0.001	92.00%
Moore et al. (2015)	0.363 [0.271,0.448]	<0.001	91.80%
Nygren et al. (2005)	0.364 [0.275,0.447]	<0.001	92.00%
Polson et al. (2018)	0.378 [0.297,0.453]	<0.001	91.90%
Scelzo et al. (2018) (YO)	0.366 [0.279,0.446]	<0.001	92.00%
Scelzo et al. (2018) (OO)	0.374 [0.292,0.45]	<0.001	92.00%
Schure et al. (2013) (adjusted)	0.394 [0.331,0.455]	<0.001	91.00%
Wells (2009)	0.348 [0.268,0.424]	<0.001	91.40%
Wells (2010)	0.359 [0.269,0.443]	<0.001	91.80%
Pooled estimate	**0.365 [0.284,0.442]**	**<0.001**	**91.30%**
Self-rated health total			
Liddell & Ferreira (2019)	0.318 [0.266,0.37]	<0.001	38.10%
Lu et al. (2017)	0.271 [0.211,0.329]	<0.001	68.80%
Smith (2009)	0.297 [0.228,0.362]	<0.001	82.60%
Wagnild (2003) (low income)	0.302 [0.239,0.363]	<0.001	82.40%
Wagnild (2003) (high income)	0.285 [0.218,0.349]	<0.001	80.70%
Wagnild (2003) (low income)2	0.293 [0.224,0.358]	<0.001	82.20%
Wagnild (2003) (high income)2	0.29 [0.22,0.356]	<0.001	81.40%
Wagnild (2003) (low income)3	0.293 [0.225,0.358]	<0.001	82.40%
Wagnild & Torma (2013)	0.287 [0.224,0.348]	<0.001	81.60%
Wagnild & Young (1993)	0.301 [0.229,0.369]	<0.001	82.10%
Pooled estimate	**0.293 [0.231,0.354]**	**<0.001**	**80.70%**
Social support			
Freitag & Schmidt (2016)	0.257 [0.115,0.388]	<0.001	83.80%
King & Richardson (2016)	0.275 [0.128,0.41]	<0.001	85.80%
Li et al. (2015)	0.222 [0.136,0.306]	<0.001	62.60%
McClain et al. (2018)	0.26 [0.123,0.388]	<0.001	85.40%
Moore et al. (2015)	0.291 [0.149,0.42]	<0.001	82.50%
Polson et al. (2018)	0.295 [0.166,0.413]	<0.001	85.30%
Torma et al. (2013)	0.299 [0.169,0.419]	<0.001	84.00%
Wells (2009)	0.283 [0.142,0.412]	<0.001	85.90%
Pooled estimate	**0.273 [0.149,0.389]**	**<0.001**	**83.60%**
Friend network size			
McKibbin et al 2016	0.207 [0.109,0.302]	<0.001	0.00%
Wells 2009	0.239 [0.152,0.323]	<0.001	0.00%
Wells 2010	0.253 [0.144,0.356]	<0.001	0.00%
Pooled estimate	**0.232 [0.154,0.308]**	**<0.001**	**0.00%**
Age			
Bartley et al. (2019)	0.004 [-0.098,0.105]	0.945	83.20%
Couto et al. (2011)	0.009 [-0.099,0.117]	0.868	83.60%
Fullen et al. (2018)	0.003 [-0.102,0.108]	0.952	80.60%

Lamond et al. (2008)	0.038 [-0.073,0.148]	0.5	85.00%
Lee et al. (2008)	0.013 [-0.099,0.125]	0.821	83.40%
Li et al. (2015)	0.03 [-0.082,0.142]	0.6	85.20%
Liddell & Ferreira (2019)	0.04 [-0.071,0.149]	0.482	80.70%
Polson et al. (2018)	0.043 [-0.058,0.143]	0.407	84.80%
Rossi et al. (2007)	0.034 [-0.074,0.141]	0.543	85.20%
Scelzo et al. (2018) (YO)	0.041 [-0.061,0.142]	0.427	84.80%
Scelzo et al. (2018) (OO)	0.016 [-0.091,0.122]	0.773	84.90%
Torma et al. (2013)	0.003 [-0.102,0.108]	0.957	79.30%
Pooled estimate	**0.023 [-0.079,0.125]**	**0.661**	**83.70%**
Gender			
Bartley et al. (2019)	0.049 [-0.031,0.127]	0.23	45.60%
Couto et al. (2011)	0.049 [-0.034,0.133]	0.248	44.50%
Fullen et al. (2018)	0.064 [-0.017,0.145]	0.12	26.60%
Li et al. (2015)	0.093 [0.051,0.135]	<0.001	0.00%
Liddell & Ferreira (2019)	0.008 [-0.073,0.09]	0.839	0.00%
Polson et al. (2018)	0.047 [-0.032,0.126]	0.245	45.40%
Pooled estimate	**0.054 [-0.018,0.126]**	**0.143**	**32.00%**
Race			
Bartley et al 2019	0.108 [-0.015,0.228]	0.086	0.00%
Fullen et al 2018	-0.046 [-0.271,0.184]	0.698	34.90%
Polson et al 2018	0 [-0.263,0.264]	0.998	70.90%
Pooled estimate	**0.034 [-0.129,0.195]**	**0.682**	**42.20%**
Education			
Bartley et al 2019	0.085 [0.032,0.137]	0.002	48.60%
Fullen et al 2018	0.083 [0.023,0.142]	0.007	52.90%
Lamond et al 2008	0.113 [0.068,0.159]	< 0.001	31.90%
Li et al 2015	0.102 [0.05,0.153]	< 0.001	34.20%
Silverman et al 2015	0.066 [0.019,0.111]	0.005	32.70%
Pooled estimate	**0.09 [0.039,0.141]**	**< 0.001**	**43.00%**
Marital status			
Bartley et al. (2019)	0.098 [0.002,0.192]	0.0445	67.90%
King & Richardson (2016)	-0.143 [-0.525,0.288]	0.5214	91.30%
Liddell & Ferreira (2019)	-0.099 [-0.565,0.415]	0.72	93.20%
Pooled estimate	**-0.033 [-0.329,0.269]**	**0.8354**	**86.50%**
Income			
Bartley et al. (2019)	0.157 [0.098,0.215]	< 0.001	24.60%
King & Richardson (2016)	0.28 [-0.045,0.552]	0.09023	84.60%
Silverman et al. (2015)	0.311 [0.06,0.526]	0.01601	72.10%
Pooled estimate	**0.234 [0.075,0.382]**	**0.00416**	**73.10%**
Psychological distress			
Baldwin et al. (2011)	-0.462 [-0.603,-0.292]	<0.001	59.70%
Moore et al. (2015)	-0.38 [-0.512,-0.231]	<0.001	0.00%
Ong et al. (2006) (Study 1a)	-0.471 [-0.599,-0.32]	<0.001	60.70%
Ong et al. (2006) (Study 1b)	-0.496 [-0.61,-0.362]	<0.001	43.00%
Ong et al. (2006) (Study 2)	-0.473 [-0.603,-0.32]	<0.001	58.60%

Pooled estimate	**-0.463 [-0.582,-0.326]**	**<0.001**	**55.20%**
Optimism			
Baldwin et al. (2011)	0.573 [0.325,0.747]	<0.001	97.70%
Lamond et al. (2008)	0.585 [0.338,0.757]	<0.001	94.20%
Lee et al. (2008)	0.572 [0.307,0.754]	<0.001	97.70%
Lu et al. (2017)	0.443 [0.403,0.481]	<0.001	0.00%
Pooled estimate	**0.549 [0.354,0.698]**	**<0.001**	**96.60%**
Spirituality			
Lee et al. (2008)	0.279 [0.238,0.319]	< 0.001	0.00%
Vahia et al. (2011)	0.205 [0.083,0.32]	0.001	0.00%
Polson et al. (2018)	0.276 [0.236,0.315]	< 0.001	0.00%
Pooled estimate	**0.269 [0.22,0.317]**	**< 0.001**	**0.00%**
Positive daily emotions			
Ong et al. (2006) (Study 1a)	0.388 [0.171,0.57]	< 0.001	0.00%
Ong et al. (2006) (Study 1b)	0.41 [0.17,0.604]	0.001	0.00%
Ong et al. (2006) (Study 2)	0.386 [0.155,0.577]	0.001	0.00%
Pooled estimate	**0.394 [0.209,0.552]**	**< 0.001**	**0.00%**
Negative daily emotions			
Ong et al. (2006) (Study 1a)	-0.209 [-0.438,0.046]	0.107	14.80%
Ong et al. (2006) (Study 1b)	-0.243 [-0.472,0.017]	0.066	0.00%
Ong et al. (2006) (Study 2)	-0.098 [-0.336,0.152]	0.443	0.00%
Pooled estimate	**-0.182 [-0.37,0.02]**	**0.077**	**0.00%**
Morale			
Wagnild (2003) (low income)	0.275 [0.168,0.376]	<0.001	57.80%
Wagnild (2003) (high income)	0.323 [0.231,0.41]	<0.001	22.40%
Wagnild (2003) (low income)	0.26 [0.159,0.356]	<0.001	46.30%
Wagnild & Young (1993)	0.308 [0.131,0.465]	<0.001	66.20%
Pooled estimate	**0.291 [0.191,0.384]**	**<0.001**	**49.40%**
Health promoting lifestyle			
Wagnild (2003) (high income)	0.528 [0.394,0.641]	<0.001	0.00%
Wagnild (2003) (low income)	0.529 [0.434,0.612]	<0.001	0.00%
Wagnild & Torma (2013)	0.53 [0.449,0.602]	<0.001	0.00%
Pooled estimate	**0.529 [0.451,0.6]**	**<0.001**	**0.00%**

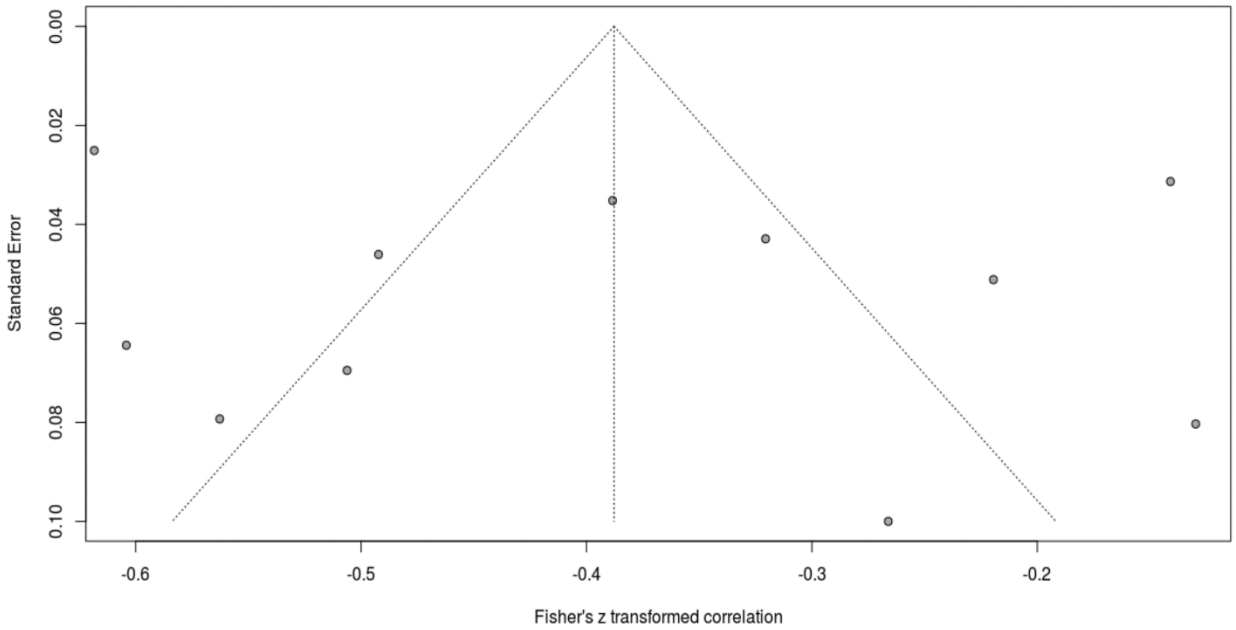
Supplementary Figure 10a. Publication bias analysis: age

Age



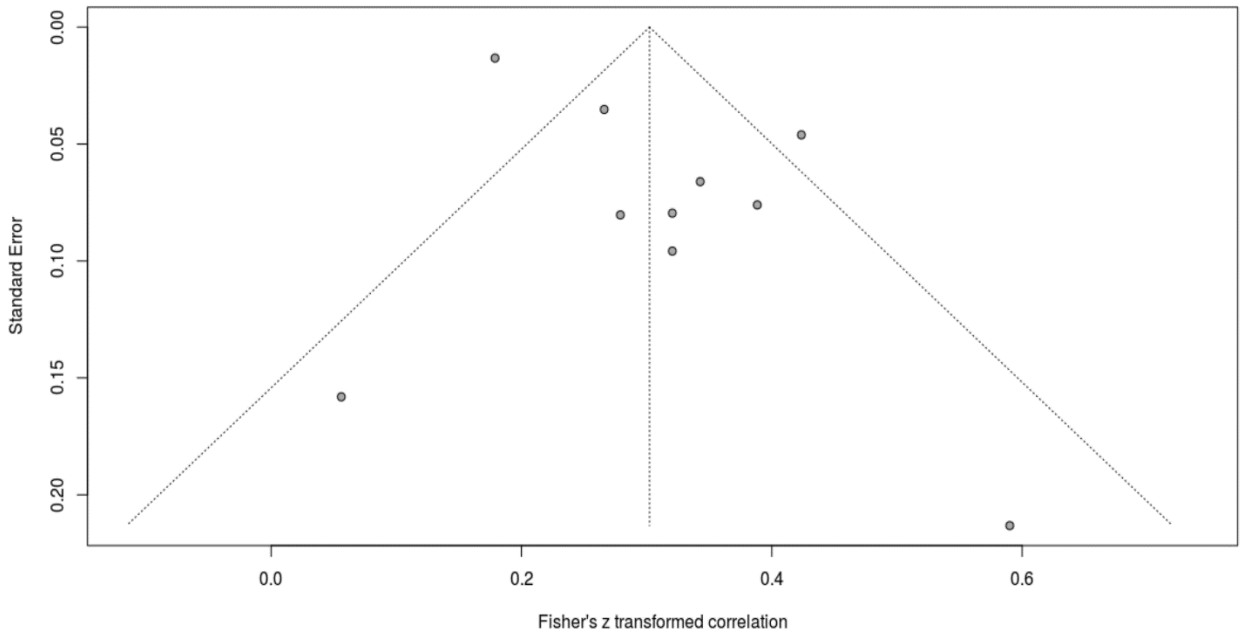
Supplementary Figure 10b. Publication bias analysis: depressive symptoms

Depressive symptoms



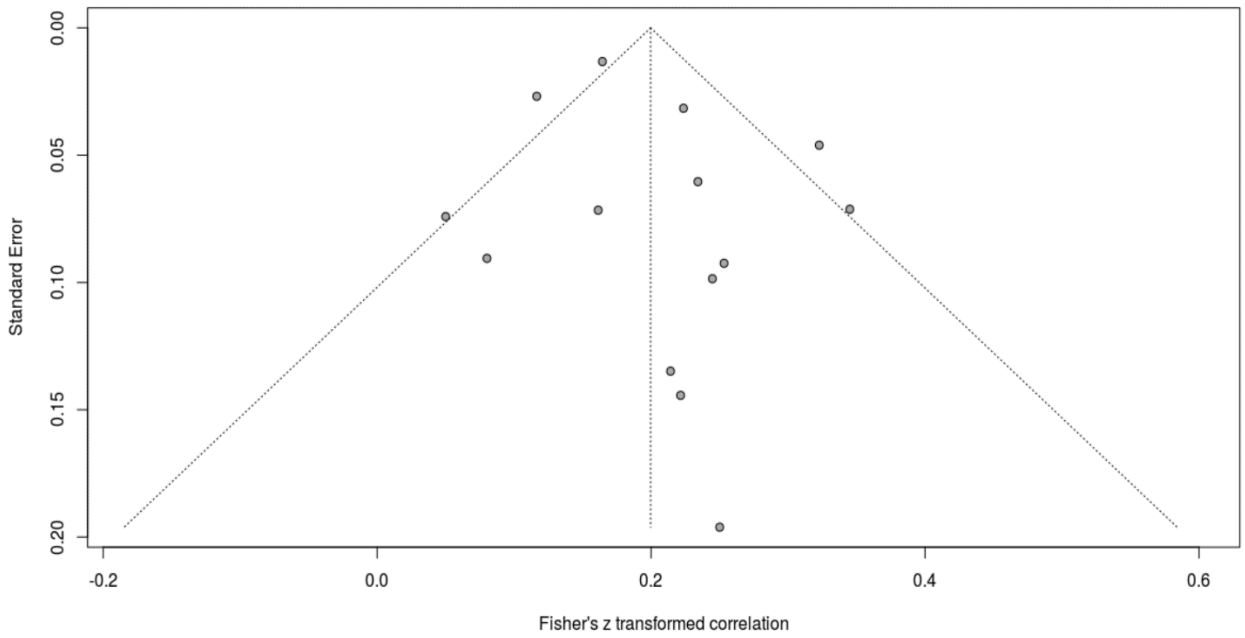
Supplementary Figure 10c. Publication bias analysis: self-rated health total

Self-rated health total



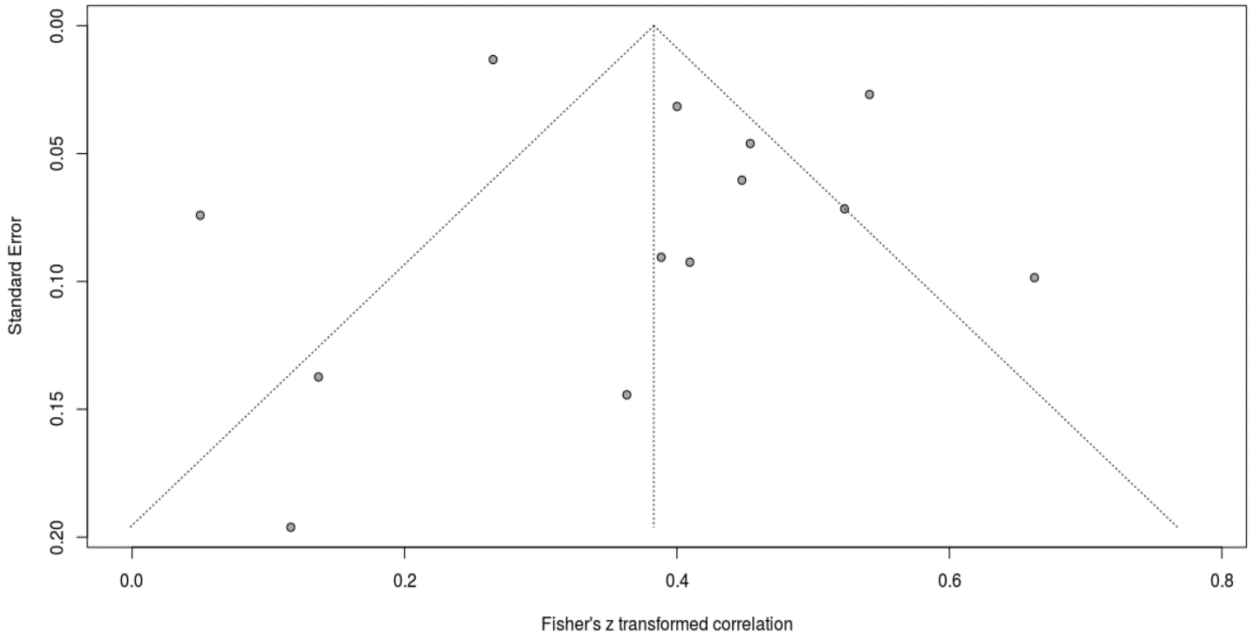
Supplementary Figure 10d. Publication bias analysis: self-rated physical health

Self-rated physical health



Supplementary Figure 10e. Publication bias analysis: self-rated mental health

Self-rated mental health



Supplementary References

Aromataris, E, & Munn, Z. (2020). *JBI Manual for Evidence Synthesis*. https://synthesismanual.jbi.global. https://doi.org/10.46658/JBIMES-20-01

Baldwin, D. R., Jackson III, D., Okoh, I., & Cannon, R. L. (2011). Resiliency and optimism: An African American senior citizen's perspective. *Journal of Black Psychology*, *37*(1), 24-41.

Bane, M. S. (1998). *Relationship between psychological resilience and social support in predicting affect and health in older adults*. Dissertation.

Bartley, E. J., Palit, S., Fillingim, R. B., & Robinson, M. E. (2019). Multisystem Resiliency as a Predictor of Physical and Psychological Functioning in Older Adults with Chronic Low Back Pain. *Frontiers in psychology*, *10*, 1932.

Bartone, P. T. (1991, June). *Development and validation of a short hardiness measure*. In annual convention of the American Psychological Society. Washington DC.

Bartone, I. T. (1995, June). *A short hardiness scale*. Paper presented at the American Psychological Society Annual Convention, New York.

Bartone, P. T. (2007). Test-retest reliability of the dispositional resilience scale-15, a brief hardiness scale. *Psychological reports*, *101*(3), 943-944.

Bartone, P. T., Ursano, R. J., Wright, K. M., & Ingraham, L. H. (1989). The impact of a military air disaster on the health of assistance workers. *Journal of nervous and mental disease*, *177*(6), 317-328.

Bernstein, K., Park, S. Y., & Nokes, K. M. (2017). Resilience and depressive symptoms among Korean Americans with history of traumatic life experience. *Community mental health journal*, *53*(7), 793-801.

Beutel, M. E., Glaesmer, H., Decker, O., Fischbeck, S., & Brähler, E. (2009). Life satisfaction, distress, and resiliency across the life span of women. *Menopause*, *16*(6), 1132-1138.

Block, J. (2002). *Personality as an affect-processing system: Toward an integrative theory*. New York: Psychology Press.

Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: conceptual and empirical connections and separateness. *Journal of personality and social psychology*, *70*(2), 349.

Boseman, G. (2001). *Correlates of morale in elderly African-American women*. Dissertation.

Brennan, S. L., Irwin, J., Drincic, A., Amoura, N. J., Randall, A., & Smith-Sallans, M. (2017). Relationship among gender-related stress, resilience factors, and mental health in a Midwestern US transgender and gender-nonconforming population. *International Journal of Transgenderism*, *18*(4), 433-445.

Campbell-Sills, L., Forde, D. R., & Stein, M. B. (2009). Demographic and childhood environmental predictors of resilience in a community sample. *Journal of psychiatric research*, *43*(12), 1007-1012.

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor–Davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress: Official Publication of the International Society for Traumatic Stress Studies*, *20*(6), 1019-1028.

Carandang, R. R., Shibanuma, A., Kiriya, J., Asis, E., Chavez, D. C., Meana, M., ... & Jimba, M. (2019). Determinants of depressive symptoms in Filipino senior citizens of the community-based ENGAGE study. *Archives of gerontology and geriatrics*, *82*, 186-191.

Clark, P. G., Greene, G. W., Blissmer, B. J., Lees, F. D., Riebe, D. A., & Stamm, K. E. (2019). Trajectories of maintenance and resilience in healthful eating and exercise behaviors in older adults. *Journal of aging and health*, *31*(5), 861-882.

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and anxiety*, *18*(2), 76-82.

Cunha, G. L. D., Cabral, S. M., & Santos, G. A. D. (2017). Analysis of the relationship between the syndrome of frailty and cognitive deficit in older adults with independent living. *Análise Psicológica*, *35*(1), 37-43.

Davidson, J.R. (2020, January 1). *Connor-Davidson Resilience Scale (CD-RISC) Manual*. Retrieved from: www.cd-risc.com.

Driver, S., Warren, A. M., Reynolds, M., Agtarap, S., Hamilton, R., Trost, Z., & Monden, K. (2016). Identifying predictors of resilience at inpatient and 3-month post-spinal cord injury. *The journal of spinal cord medicine*, *39*(1), 77-84.

Ebly, E. M., Hogan, D. B., & Fung, T. S. (1996). Correlates of self-rated health in persons aged 85 and over: results from the Canadian Study of Health and Aging. *Canadian journal of public health = Revue canadienne de sante publique*, *87*(1), 28-31.

Emlet, C. A., Shiu, C., Kim, H. J., & Fredriksen-Goldsen, K. (2017). Bouncing back: resilience and mastery among HIV-positive older gay and bisexual men. *The Gerontologist, 57*(suppl_1), S40-S49.

Eshel, Y., Kimhi, S., Lahad, M., Leykin, D., & Goroshit, M. (2018). Risk factors as major determinants of resilience: A replication study. *Community mental health journal*, *54*(8), 1228-1238.

Freitag, S., & Schmidt, S. (2016). Psychosocial correlates of frailty in older adults. *Geriatrics*, *1*(4), 26.

Fullen, M. C. (2016). "*Gray Hair is a Crown of Glory": A Multivariate Analysis of Wellness, Resilience, and Internalized Ageism in Older Adulthood* (Doctoral dissertation, The Ohio State University).

Fullen, M. C., & Granello, D. H. (2018). Holistic wellness in older adulthood: group differences based on age and mental health. *Journal of Holistic Nursing*, *36*(4), 395-407.

Fullen, M.C., Richardson, V.E. & Granello, D.H. (2018). Comparing successful aging, resilience, and holistic wellness as predictors of the good life. *Educational Gerontology*, *44*(7), 459-468.

Gooding, P. A., Hurst, A., Johnson, J., & Tarrier, N. (2012). Psychological resilience in young and older adults. *International journal of geriatric psychiatry*, *27*(3), 262-270.

Guest, R., Craig, A., Tran, Y., & Middleton, J. (2015). Factors predicting resilience in people with spinal cord injury during transition from inpatient rehabilitation to the community. Spinal Cord, *53*(9), 682-686.

Hardy, S. E., Concato, J., & Gill, T. M. (2002). Stressful life events among community-living older persons. *Journal of General Internal Medicine*, *17*(11), 841-847.

Hardy, S. E., Concato, J., & Gill, T. M. (2004). Resilience of community-dwelling older persons. *Journal of the American Geriatrics Society*, *52*(2), 257-262.

Heisel, M. J., Moore, S. L., Flett, G. L., Norman, R. M. G., Links, P. S., Eynan, R., ... & Farrell, B. (2020). Meaning-centered men's groups: Initial findings of an intervention to enhance resiliency and reduce suicide risk in men facing retirement. *Clinical gerontologist*, *43*(1), 76-94.

Holden, K. B., Bradford, L. D., Hall, S. P., & Belton, A. S. (2013). Prevalence and correlates of depressive symptoms and resiliency among African American women in a community-based primary health care center. *Journal of health care for the poor and underserved*, *24*(4 0), 79.

Holmes, S. D., Galik, E., & Resnick, B. (2019). The mediating effect of resilience between social support for exercise and resident satisfaction in assisted living. *Journal of Housing For the Elderly*, *33*(1), 56-71.

Jeste, D. V., Savla, G. N., Thompson, W. K., Vahia, I. V., Glorioso, D. K., Martin, A. V. S., ... & Depp, C. A. (2013). Association between older age and more successful aging: critical role of resilience and depression. *American Journal of Psychiatry*, *170*(2), 188-196.

Jeste, D.V., Glorioso, D., Lee, E.E., Daly, R., Graham, S., Liu, J., Paredes, A.M., Nebeker, C., Tu, X.M., Twamley, E.W. & Van Patten, R. (2019). Study of independent living residents of a continuing care senior housing community: Sociodemographic and clinical associations of cognitive, physical, and mental health. *The American Journal of Geriatric Psychiatry*, *27*(9), 895-907.

Johnson, J. D. (2002). *Relationship between resiliency, self-care agency, and self-care in the community-dwelling older adult*. Dissertation.

Johnson, J., Gooding, P., & Tarrier, N. (2008). Suicide risk in schizophrenia: explanatory models and clinical implications, The Schematic Appraisal Model of Suicide (SAMS). *Psychology and Psychotherapy: Theory, Research and Practice*, *81*(1), 55-77.

Johnson, J., Gooding, P. A., Wood, A. M., & Tarrier, N. (2010). Resilience as positive coping appraisals: Testing the schematic appraisals model of suicide (SAMS). *Behaviour Research and Therapy*, *48*(3), 179-186.

Kilic, S. A., Dorstyn, D. S., & Guiver, N. G. (2013). Examining factors that contribute to the process of resilience following spinal cord injury. *Spinal cord*, *51*(7), 553-557.

Klinedinst, N. J., & Resnick, B. (2014). Volunteering and depressive symptoms among residents in a continuing care retirement community. *Journal of gerontological social work*, *57*(1), 52-71.

King, S.D., & Richardson, V.E. (2016). Influence of income, being partnered/married, resilience, and discrimination on mental health distress for midlife and older gay men: Mental health distress among midlife and older gay men: The importance of partners and resilience. *Journal of Gay & Lesbian Mental Health*, *20*(2), 127-151.

Kuwert, P., Knaevelsrud, C., & Pietrzak, R.H. (2014). Loneliness among older veterans in the United States: results from the National Health and Resilience in Veterans Study. *The American Journal of Geriatric Psychiatry*, *22*(6), 564-569.

Lamet, A., Szuchman, L., Perkel, L., & Walsh, S. (2008). Risk factors, resilience, and psychological distress among holocaust and nonholocaust surviviors in the post-9/11 environment. *Educational Gerontology*, *35*(1), 32-46.

Lamond, A.J., Depp, C.A., Allison, M., Langer, R., Reichstadt, J., Moore, D.J., Golshan, S., Ganiats, T.G., & Jeste, D.V. (2008). Measurement and predictors of resilience among community-dwelling older women. *Journal of psychiatric research*, *43*(2), 148-154.

Lau, R., Morse, C. A., & Macfarlane, S. (2010). Psychological factors among elderly women with suicidal intentions or attempts to suicide: a controlled comparison. *Journal of women & aging*, *22*(1), 3-14.

Lau, S. Y. Z., Guerra, R. O., de Souza Barbosa, J. F., & Phillips, S. P. (2018). Impact of resilience on health in older adults: a cross-sectional analysis from the International Mobility in Aging Study (IMIAS). *BMJ open*, *8*(11), e023779.

Lee, H.S., Brown, S.L., Mitchell, M.M., & Schiraldi, G.R. (2008). Correlates of resilience in the face of adversity for Korean women immigrating to the US. *Journal of Immigrant and Minority Health*, *10*(5), 415-422.

Lee M.E., Jung M.H., Kim S., & Kim B. (2018). Risk and protective factors affecting suicide attempts among Korean elderly living alone in urban areas. *Asia life sciences*, *27*(2), 249-261.

Lei P. Q., Liu C.-N., Gao Y., & Xue M. (2018). Psychosocial Factors and Frailty in Community-dwelling Older People. *Chinese General Practice*, *21*(2), 180.

Li, J., Theng, Y.L., & Foo, S. (2015). Depression and psychosocial risk factors among community-dwelling older adults in Singapore. *Journal of cross-cultural gerontology*, *30*(4), 409-422.

Liddell, J., & Ferreira, R.J. (2019). Predictors of Individual resilience characteristics among individuals ages 65 and older in post-disaster settings. *Disaster medicine and public health preparedness*, *13*(2), 256-264.

Liebenberg, L., & Moore, J. C. (2018). A social ecological measure of resilience for adults: The RRC-ARM. *Social Indicators Research*, *136*(1), 1-19.

Lim, M.L., Lim, D., Gwee, X., Nyunt, M.S.Z., Kumar, R., & Ng, T.P. (2015). Resilience, stressful life events, and depressive symptomatology among older Chinese adults. *Aging & mental health*, *19*(11), 1005-1014.

Lu, C., Yuan, L., Lin, W., Zhou, Y., & Pan, S. (2017). Depression and resilience mediates the effect of family function on quality of life of the elderly. *Archives of gerontology and geriatrics*, *71*, 34-42.

Manning, L.K., Carr, D.C., & Kail, B.L. (2016). Do higher levels of resilience buffer the deleterious impact of chronic illness on disability in later life? *The Gerontologist*, *56*(3), 514-524.

Marciano, H., Kimhi, S., & Eshel, Y. (2019). Predictors of individual, community and national resiliencies of Israeli Jews and Arabs. *International Journal of Psychology. 55*(4), 553–561.

Martin, A.S., Palmer, B.W., Rock, D., Gelston, C.V., & Jeste, D.V. (2015b). Associations of self-perceived successful aging in young-old versus old-old adults. *International psychogeriatrics*, *27*(4), 601-609.

Martins, A. B., Dos Santos, C. M., Hilgert, J. B., de Marchi, R. J., Hugo, F. N., & Pereira Padilha, D. M. (2011). Resilience and self-perceived oral health: a hierarchical approach. *Journal of the American Geriatrics Society*, *59*(4), 725-731.

McClain, J., Gullatt, K., & Lee, C. (2018). *Resilience and Protective Factors in Older Adults*. [master thesis] USA: University of California.

McKibbin, C., Lee, A., Steinman, B.A., Carrico, C., Bourassa, K., & Slosser, A. (2016). Health status and social networks as predictors of resilience in older adults residing in rural and remote environments. *Journal of aging research*, *2016*, 4305894.

Mehta, M., Whyte, E., Lenze, E., Hardy, S., Roumani, Y., Subashan, P., Huang, W., & Studenski, S. (2008). Depressive symptoms in late life: associations with apathy, resilience and disability vary between young-old and old-old. *International Journal of Geriatric Psychiatry: A journal of the psychiatry of late life and allied sciences*, *23*(3), 238-243.

Mertens, V. C., Bosma, H., Groffen, D. A., & van Eijk, J. T. M. (2012). Good friends, high income or resilience? What matters most for elderly patients?.*The European Journal of Public Health*, *22*(5), 666-671.

Min, J. H., Ha, L. M., & Young, K. H. (2017). Factors Influencing Self-care in Elders with Hypertension Living at Home. *Journal of Korean Academy of Fundamentals of Nursing*, *24*(1), 72-83.

Moe, A., Hellzen, O., Ekker, K., & Enmarker, I. (2013). Inner strength in relation to perceived physical and mental health among the oldest old people with chronic illness. *Aging & Mental Health*, *17*(2), 189-196.

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med, 6*(7): e1000097.

Montross, L.P., Depp, C., Daly, J., Reichstadt, J., Golshan, S., Moore, D., Sitzer, D., & Jeste, D.V. (2006). Correlates of self-rated successful aging among community-dwelling older adults. *The American Journal of Geriatric Psychiatry*, *14*(1), 43-51.

Moore, R.C., Eyler, L.T., Mausbach, B.T., Zlatar, Z.Z., Thompson, W.K., Peavy, G., Fazeli, P.L., & Jeste, D.V. (2015). Complex interplay between health and successful aging: role of perceived stress, resilience, and social support. *The American Journal of Geriatric Psychiatry*, *23*(6), 622-632.

Morote, R., Hjemdal, O., Uribe, P. M., & Corveleyn, J. (2017). Psychometric properties of the Resilience Scale for Adults (RSA) and its relationship with life-stress, anxiety and depression in a Hispanic Latin-American community sample. *PloS one*, *12*(11).

NIH. (2020). *Study Quality Assessment Tools: Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies*. https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools

Netuveli, G., Wiggins, R. D., Montgomery, S. M., Hildon, Z., & Blane, D. (2008). Mental health and resilience at older ages: Bouncing back after adversity in the British Household Panel Survey. *Journal of Epidemiology & Community Health*, *62*(11), 987-991.

Nygren, B., Aléx, L., Jonsén, E., Gustafson, Y., Norberg, A., & Lundman, B. (2005). Resilience, sense of coherence, purpose in life and self-transcendence in relation to perceived physical and mental health among the oldest old. *Aging & mental health*, *9*(4), 354-362.

Ong, A.D., Bergeman, C.S., Bisconti, T.L., & Wallace, K.A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *Journal of personality and social psychology*, *91*(4), 730.

Pakenham, K. I., Mawdsley, M., Brown, F. L., & Burton, N. W. (2018). Pilot evaluation of a resilience training program for people with multiple sclerosis. *Rehabilitation psychology*, *63*(1), 29.

de Paula Couto, M. C. P., Koller, S. H., & Novo, R. (2011). Stressful life events and psychological well-being in a Brazilian sample of older persons: The role of resilience. *Aging international*, *36*(4), 492-505.

Pearlin, L.I., & Schooler, C. (1978). The structure of coping. *Journal of Health and Social Behavior*, *19*, 2-21.

Phillips, S. P., Auais, M., Belanger, E., Alvarado, B., & Zunzunegui, M. V. (2016). Life-course social and economic circumstances, gender, and resilience in older adults: The longitudinal International Mobility in Aging Study (IMIAS). *SSM-Population Health*, *2*, 708-717.

Pietrzak, R. H., Tsai, J., Kirwin, P. D., & Southwick, S. M. (2014). Successful aging among older veterans in the United States. *The American Journal of Geriatric Psychiatry*, *22*(6), 551-563.

Polson, E.C., Gillespie, R., & Myers, D.R. (2018). Hope and Resilience among Vulnerable, Community-Dwelling Older Persons. *Social Work & Christianity*, *45*(1).

Prince-Embury, S. (2013). The ego-resiliency scale by Block and Kremen (1996) and trait ego-resiliency. In S. Prince-Embury & D.H. Saklofske (Eds.), *Resilience in children, adolescents, and adults* (pp. 135-138). New York: Springer.

Resnick, B. A., & Inguito, P. L. (2011). The Resilience Scale: Psychometric properties and clinical applicability in older adults. *Archives of psychiatric nursing*, *25*(1), 11-20.

Reyes, A. T., Constantino, R. E., Cross, C. L., Tan, R. A., Bombard, J. N., & Acupan, A. R. (2019). Resilience and psychological trauma among Filipino American women. *Archives of psychiatric nursing*, *33*(6), 177-185.

Roos, N. P., & Havens, B. (1991). Predictors of successful aging: a twelve-year study of Manitoba elderly. *American Journal of Public Health*, *81*(1), 63-68.

Rossi, N.E., Bisconti, T.L., & Bergeman, C.S. (2007). The role of dispositional resilience in regaining life satisfaction after the loss of a spouse. *Death studies*, *31*(10), 863-883.

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, *37*(4), 433-440.

Sawyer, P., & Allman, R. M. (2010). 12 Resilience in mobility in the context of chronic disease and aging: cross-sectional and prospective findings from the University of Alabama at Birmingham (UAB) Study of Aging. *New Frontiers in Resilient Aging: Life-Strengths and Well-Being in Late Life*, *310*.

Scelzo, A., Di Somma, S., Antonini, P., Montross, L.P., Schork, N., Brenner, D., & Jeste, D.V. (2018). Mixed-methods quantitative–qualitative study of 29 nonagenarians and centenarians in rural Southern Italy: focus on positive psychological traits. *International Psychogeriatrics*, *30*(1), 31-38.

Schure, M.B., Odden, M., & Goins, R.T. (2013). The association of resilience with mental and physical health among older American Indians: The native elder care study. *American Indian and Alaska native mental health research*, *20*(2), 27.

Serrano-Parra, M. D., Garrido-Abejar, M., Notario-Pacheco, B., Bartolomé-Gutierrez, R., Solera-Martínez, M., & Martínez-Vizcaino, V. (2012). Validez de la escala de Resiliencia de Connor-Davidson (CD-RISC) en una población de mayores entre 60 y 75 años. *International Journal of psychological research*, *5*(2), 49-57.

Sharpley, C. F., Palanisamy, S. K., Metcalf, K., Jones, K. A., Kelly, B., & McFarlane, J. R. (2014). A comparison of a single genetic factor, two stress factors, and one psychosocial coping factor as predictors of depression in an Australian community sample. *Archives of Psychiatry and Psychotherapy*, *4*(16), 15-26.

Shen, K., & Zeng, Y. (2011). The association between resilience and survival among Chinese elderly. In *Resilience in Aging* (pp. 217-229). Springer, New York, NY.

Silverman, A.M., Molton, I.R., Alschuler, K.N., Ehde, D.M., & Jensen, M.P. (2015). Resilience predicts functional outcomes in people aging with disability: A longitudinal investigation. *Archives of physical medicine and rehabilitation*, *96*(7), 1262-1268.

Smith, P.R. (2009). Resilience: resistance factor for depressive symptom. *Journal of Psychiatric and Mental Health Nursing*, *16*(9), 829-837.

Smith, P.R. (2012). Resilience and stigma influence older African Americans seeking care. *ABNF Journal, 23*(4).

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International journal of behavioral medicine*, *15*(3), 194-200.

Smith, J. L., & Hollinger-Smith, L. (2015). Savoring, resilience, and psychological well-being in older adults. *Aging & mental health*, *19*(3), 192-200.

Spies, G., & Seedat, S. (2014). Depression and resilience in women with HIV and early life stress: Does trauma play a mediating role? A cross-sectional study. *BMJ open*, *4*(2), e004200.

Stewart, J. M., Auais, M., Belanger, E., & Phillips, S. P. (2019). Comparison of self-rated and objective successful aging in an international cohort. *Aging & Society*, *39*(7), 1317-1334.

Sun, J., & Buys, N. (2014). A comparison between a Tai Chi program and a usual medical care program in chronic cardiovascular disease participants in quality of life, psychological health, resilience, blood pressure and body mass index. *International Journal on Disability and Human Development*, *13*(1), 113-120.

Talsma, A. N. (1996). *Evaluation of a theoretical model of resilience and select predictors of resilience in a sample of community-based elderly*. Doctoral dissertation: The University of Michigan.

Tomás, J. M., Sancho, P., Melendez, J. C., & Mayordomo, T. (2012). Resilience and coping as predictors of general well-being in the elderly: A structural equation modeling approach. *Aging & Mental Health*, *16*(3), 317-326.

Topel, M. L., Kim, J. H., Mujahid, M. S., Ko, Y. A., Vaccarino, V., Mubasher, M., ... & Quyyumi, A. A. (2019). Individual Characteristics of Resilience are Associated With Lower-Than-Expected Neighborhood Rates of Cardiovascular Disease in Blacks: Results From the Morehouse-Emory Cardiovascular (MECA) Center for Health Equity Study. *Journal of the American Heart Association*, *8*(12), e011633.

Torma, L.M., Houck, G.M., Wagnild, G.M., Messecar, D., & Jones, K.D. (2013). Growing old with fibromyalgia: factors that predict physical function. *Nursing research*, *62*(1), 16-24.

Tugade, M. M., Fredrickson, B. L., & Feldman Barrett, L. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of personality*, *72*(6), 1161-1190.

Vahia, I.V., Depp, C.A., Palmer, B.W., Fellows, I., Golshan, S., Thompson, W., Allison, M., & Jeste, D.V. (2011). Correlates of spirituality in older women. *Aging & mental health*, *15*(1), 97-102.

Vahia, I. V., Meeks, T. W., Thompson, W. K., Depp, C. A., Zisook, S., Allison, M., ... & Jeste, D. V. (2010). Subthreshold depression and successful aging in older women. *The American Journal of Geriatric Psychiatry*, *18*(3), 212-220.

Wagnild, G. (2003). Resilience and successful aging: Comparison among low and high income older adults. *Journal of gerontological nursing*, *29*(12), 42-49.

Wagnild, G.M., & Torma, L.M. (2013). Assessing resilience in older frontier women. In A.C Winters & H.J. Lee (Eds.), *Rural nursing: Concepts, theory, and practice* (pp. 79-94).

Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement*, *1*(2), 165-178.

Wallace, K. A. (1999). *A theoretical examination of protective factors in later life*. Doctoral dissertation: University of Notre Dame.

Wallace, K.A., Bisconti, T.L., & Bergeman, C.S. (2001). The mediational effect of hardiness on social support and optimal outcomes in later life. *Basic and applied social psychology*, *23*(4), 267-276.

Wells, M. (2009). Resilience in rural community-dwelling older adults. *The Journal of Rural Health*, *25*(4), 415-419.

Wells, M. (2010). Resilience in older adults living in rural, suburban, and urban areas. *Online Journal of Rural Nursing and Health Care*, *10*(2), 45-54.

Wisco, B. E., Marx, B. P., Wolf, E. J., Miller, M. W., Southwick, S. M., & Pietrzak, R. H. (2014). Posttraumatic stress disorder in the US veteran population: results from the National Health and Resilience in Veterans Study. *The Journal of clinical psychiatry*, *75*(12), 1338-1346.

Yang, Y., & Wen, M. (2015). Psychological resilience and the onset of activity of daily living disability among older adults in China: A nationwide longitudinal analysis. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *70*(3), 470-480.

You, S., & Park, M. (2017). Resilience protected against suicidal behavior for men but not women in a community sample of older adults in Korea. *Frontiers in psychology*, *8*, 401.

Zeng, Y., & Shen, K. (2010). Resilience significantly contributes to exceptional longevity. *Current gerontology and geriatrics research*, *2010*, 525693.